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Editor: H. A. Shapiro, Ph.D., M.B., Ch.B., F.R.S.S.Af.

Instruction in Forensic Medicine

Instruction in forensic medicine falls naturally into two parts:

i. The legal aspects of medical practice;

ii. The legal implications of clinical medicine.

Overloaded though the undergraduate medical curriculum has become, it is difficult to see how formal instruction and examination can be avoided in the first part, which touches on every important aspect of the doctor's professional existence, civilly and criminally. An Editorial in the *Medico-Legal Journal* (1950, **18,** 121) has drawn attention to this matter very adequately:

'No man, least of all a doctor, can know too much of the law, especially as it may affect him in his day-to-day practice . . . Every certificate signed is a legal document and every operation performed a potential technical assault, and it is on such thin ice . . . that the practitioner must tread his wary way. His patients will expect him to be *au fait* with the requirements of registration of birth and death, burial and cremation, certification of lunacy and notification of infectious disease, and so on. Failure to observe the regulations attaching to many of these duties may carry statutory penalties—doubly penal if awarded for not knowing the law as applied to his own job . . . many worthy doctors get into unnecessary trouble through ignorance or neglect of their legal position.'

This quotation by no means exhausts the extent to which the law impinges on the practice of medicine, and it emphasizes an important feature of medical training which no student can ignore or should escape.

The second part of the subject (the legal implications of medical knowledge) raises an entirely different educational problem. We must never lose sight of the primary objective to turn out as competent an all-round practitioner as possible. The efforts of experts in the forensic field (who may unconsciously be aggrandizing their subject at the expense of basic clinical training) must be resisted firmly. The need for alertness on this point is borne out by the passage from the Goodenough Report (1944) quoted by

Dr. Keith Simpson (in opening the timely discussion held at a recent meeting of the British Association of Forensic Pathologists on *The Teaching of Forensic Medicine,* and published elsewhere in this issue):

'In some medical schools the amount of instruction given to medical students on Forensic Medicine seems excessive, having regard to the needs of general practice.'

It should be recognized that there is very little peculiarly forensic which can justifiably be isolated in a medico-legal category. A certain amount of specialized and restricted laboratory and autopsy work is performed by practitioners in this field. In so far as toxicology requires purely chemical methods it has passed out of the hands of the medical practitioner. No adequate case can be made out for regarding clinical toxicology as a separate medical entity. The clinical and morbid anatomical signs of illness and death due to poisoning are, for the most part, completely non-specific. Arsenical poisoning, e.g., is usually first seen by the private practitioner, not the forensic expert, and creates a problem in differential diagnosis involving *inter alia* gastritis, laryngitis, scarlet fever, peripheral neuritis and Addison's disease. These aspects of the matter are best appreciated by the doctor thoroughly trained in general medicine.

In the same way, there is nothing uniquely forensic about the examination of an intoxicated or drugged person. A clinical examination of the nervous system is something every student is trained to do and every practitioner can be expected to undertake. A poorly trained practitioner will not be adequately helpful in the examination of cases of rape, unnatural offences, abortion, etc. even if he is dignified with some imposing title by the authority employing him.

It is true that the forensic practitioner is involved in certain special tasks, e.g. the performance of autopsies, problems of identity (anatomical and serological), traumatic pathology including ballistics (from the limited standpoint of a pathologist doing an autopsy) and certain laboratory investigations, but this territory is increasingly being relegated to the chemist, the serologist, the bacteriologist, the entomologist, etc. The undergraduate student would seem to require no more than a well-planned series of demonstrations and seminars to introduce him to the subject, without the need necessarily to sit an examination.

There is much to be said for the postponement of formal training and examination in this work to the post-graduate period. The doctor (with more adequate clinical knowledge than the student and therefore a better appreciation of forensic problems) should be inducted in autopsy technique, traumatic pathology and the limited number of laboratory investigations he can be expected to do, when he has decided to embark on a career involving these responsibilities, whether in a full-time or a part-time capacity. This is the time for his training, preferably at the expense of the authority or institution employing him. If we take the precaution to ensure that the recently qualified practitioner must undergo at least one year of training as

an intern, it is difficult to see why those who propose to embark on a career involving very exacting medico-legal duties, should not be required to complete an adequate apprenticeship at the appropriate (post-graduate) time. Professor Glaister has explained the post-graduate aspects of this educational problem very clearly in his contribution to the symposium on *The Teaching of Forensic Medicine.* Certainly no undergraduate student can expect to acquire the necessary basic instruction and techniques while he is preoccupied with becoming a clinical practitioner.

In this discussion emphasis has necessarily been on the medical student, but the need to give the legal student some training must not be overlooked. It has been our experience that a very adequate introduction to the principles involved in analysing a medical report (clinical or pathological) can be effected in a modest series of lectures and demonstrations (without the need for an examination at the end of the course). Their primary importance is to make the legal practitioner more fully aware of the limitations of medical knowledge and the proper sources to which to go for scientific assistance when the occasion requires it.

* * * *

The International Journal on Alcohol and Alcoholism

The first issue of this new journal has just been published under the editorship of Dr. E. M. Jellinek and Dr. H. Pullar-Strecker. It is the official organ of the International Institute for Research on Problems of Alcohol. There is a distinguished International Editorial Board.

This Journal, as its first number foreshadows, will undoubtedly make important contributions to the literature dealing with a problem of growing gravity all over the world. Fuller details of this publication are given in our review columns in this issue.

The Teaching of Forensic Medicine

A Symposium*

Dr. Keith Simpson: It is of the greatest importance, if this discussion is to be profitable, that we should adhere strictly to the confines of our subject. I am not unaware that in this School, home of that great teacher, Alfred Swaine Taylor, there are met to-day some of the world's most authoritative teachers in Forensic Medicine, and I earnestly hope that we shall enjoy a profitable intercourse, whether or not we find ourselves in broad agreement.

For my part I propose to restrict my opening remarks entirely to the teaching of the undergraduate; Prof. John Glaister will speak of the post-graduate and specialist; Dr. Geoffrey Barber, who lectures in the University on 'General Practice', will describe the practitioner's point of view, and Professor Kayssi of Baghdad will outline the problems of those engaged in State Medico-Legal Institute work.

1. *General Principles of Undergraduate Teaching.* Let us not forget, whether we call what we are teaching 'Medical Jurisprudence', 'Forensic Medicine' or, in accordance with world practice, 'Legal Medicine', that we are contributing to the education of a doctor; that the medical profession is still—or should be—a learned one; that we should not be content to restrict ourselves to imparting information on mere facts, to teaching tabloid formulae which will only enable the student to pass an examination in the subject. Modern medical teaching must be liberal and aim to set a high intellectual standard in order to bear the fruits of what Sir Richard Livingstone called 'the philosophy of the first rate': we must teach also the principles of clear thinking, of observation and inference—a capacity for thought and judgment.

Cardinal Newman put this principle in his own lucid style 100 years ago, writing of his pity for 'those earnest but ill-used persons who are forced to load their minds with a score of subjects against an examination, who have too much on their hands to indulge themselves in thinking or investigation, who devour premises and conclusions together with indis-

* Held at the 9th Meeting of the British Association of Forensic Pathologists at Guy's Hospital, London, on 20 November 1954. The President, Professor Sir Sydney Smith, was in the chair. The Discussion was opened by Dr. Keith Simpson.

criminate greediness'. No such load should ever be placed on the willing back of the student of medicine.

2. *When to Teach Forensic Medicine.* Since the subject is concerned largely with 'the application of the knowledge of medicine in all its branches to the needs of the law', the student must already have acquired this knowledge. He must be a senior student, preferably in the fourth or fifth year. He will also, by this time, have acquired something of the art of observation and inference, of the reasoning which is so essential to the sound application of any knowledge to some practical need.

I feel that the time has now come, also, to attend to the newly qualified practitioner as he embarks on his period of 'provisional registration'. Some half a dozen informal talks on subjects like certification, the coroner, Court evidence and fees, the examination of injured persons for law requirements, reports to solicitors, poisons law and practice, ethics and some advice about malpraxis, might 'refresh' the newly qualified doctor's approach to his practice of medicine. Not all are fortunate enough to embark on provisional practice in a place where advice and 'cover' are readily available.

3. *Who Shall Teach.* The teaching of any subject undoubtedly lays a strong duty on those who practise it. The hallmark of a great man in almost any branch of medicine has ever been his ability not merely to acquire knowledge of his subject but also to impart it. Emerson wrote: 'The greatness of any institution is often but the lengthened shadow of one man'—and not infrequently that man has been a great teacher. We must not entrust teaching to those without aptitude and a liking for it; teachers must have affection for students and concern for their future. If there is character and a vein of humour, so much the better. Everyone can recollect most vividly the teachings of men and women of character and personality: it is not merely *what* is taught but *how* it is taught.

Most of us would agree, I think, that there should be at least two levels of teaching. One should have the authority and experience of the older Head of the Department, the other should be nearer the student in his current examination problems and come from a younger member of the staff whose difficulties in clarifying his experience for teaching purposes are not so great. A fellow member of the staff of this hospital said to me the other day, 'You know, the more I get to know, the more difficult I find it to teach: almost every time I give students a working rule I realize I've seen so many exceptions to it that it's hardly fair to teach it'. How true; the clearest teachers of undergraduates are often those who have not yet acquired great experience; later nothing seems infallible.

What is, I think, fundamental is that both should have had training in pathology and forensic medicine, have both studied and practised the latter; and, above all, should have a profound interest in the future needs of the student.

4. *What, and How Much Should be Taught.* There can be little doubt that the primary aim of undergraduate teaching is to turn out a sound practising doctor, capable of developing his knowledge and experience. He should not, I feel, be burdened with the knowledge that is, later, sought in an expert—medico-legal serology, ballistics and forensic identity problems of a more highly specialized character. The Goodenough Report of 1944 said of Forensic Medicine: 'In some medical schools the amount of instruction given to medical students on Forensic Medicine seems excessive having regard to the needs of general practice'. John Fulton, Professor of History of Medicine at Yale, said, commenting on this and the more recent University Development (U. Grants) Committee Report of 1953: 'There are two matters for further attention' and 'first is the problem of the liberalization and tightening of the entire medical curriculum, the elimination of the out-moded and unusual areas of instruction, with the ultimate object of shortening the medical curriculum'.

The second was the need to create halls of residence and common rooms for students of all faculties. Anyone who has seen the 'campus' atmosphere in the American universities or in Paris at the Sorbonne will appreciate the advantages of intercourse between the students of all faculties.

Lastly, we must not neglect, in teaching those basic facts which can be illustrated from either fresh material or autopsy, to use every ancillary method available. We, here, have the advantage of departments of photography and medical illustration which have taken great pains to supply our needs in the newer 35 mm. colour slides, in films and in teaching graph, poster and chart. These are in no sense alternatives to good personal teaching: they are teaching aids, designed to help those whose memory is predominantly visual.

The same principles apply to autopsy demonstrations and cinematography, to provision of museums and exhibitions on subjects of medico-legal interest: these are all ancillary methods of instruction. Behind all there must always stand those textbooks on the subject which will disseminate through the world the teaching of some of our best remembered authorities who may never have been seen by the vast majority of their 'pupils'.

Our aim must be to teach first those things that will make the general practitioner a good doctor; to make him both sound and practical, a useful citizen to the State in its medico-legal demands—and always, if possible, an educated man. That great Liberal statesman, John Morley, once said: 'An educated man knows when a thing is proved, but an uneducated man does not'. Sound medico-legal work largely hinges on this significant difference in character.

Post-Graduate Teaching of Forensic Medicine

Prof. J. Glaister: Dr. Keith Simpson has outlined a number of aspects concerning the teaching of Forensic Medicine to undergraduates. I have been asked to follow this with some remarks on the post-graduate teaching of this subject.

There can be but little doubt that the adequate provision of facilities for such instruction is very necessary at the present time. The teaching of the undergraduate should inevitably be directed to such matters within the realm of legal medicine as will stand him in good stead in the conduct of general or other practice. With the already over-crowded university curriculum and the demands made by such important subjects as surgery, medicine, midwifery and the like, it is inevitable that the opportunity for extended student teaching is limited.

On the other hand, relatively few of those who attend lectures in legal medicine profess the subject as a speciality after graduation. For those who do wish to specialize in this branch of work, much additional instruction becomes a prerequisite before the attainment of any appointment in this field. Apart from the more sporadic demands which arise in the British Isles for post-graduate instruction, those emanating from other parts of the world are much more numerous, and it seems that existing facilities are not yet sufficiently wide for the needs.

It would appear that the proper method of dealing with post-graduate education would be through the medium of a medico-legal institute and, in my opinion, the creation of such an institute is overdue in both England and Scotland. With such facility, it would be possible to divert a great deal of medico-legal investigation, in all its phases, which at the present time seems heavily dissipated, thus centralizing it and conserving the fruits of varied investigation. Until such time as those responsible appreciate the need for such innovation, it falls upon the teaching centres to provide an opportunity for the post-graduate to acquire the necessary additional knowledge. A number of these have adequately equipped and staffed departments, where such instruction can be given, not only in the laboratories but in the lecture room, since a number of those who avail themselves of such instruction are also desirous of acquiring the methods for the teaching of the subject. Many of these are directed to post-graduate centres as a preliminary either to assuming control of a department for the first time or, as is commonly found in those who come from abroad, are on the threshold of promotion.

It is not possible, at the present time, with effectiveness, to design any hard and fast course, and it has been found advisable to keep such training as elastic as possible. The reason for this very frequently lies in the fact that those who wish instruction have specific desires in the class of work with which they wish to become more familiar. Although some may

wish general instruction, the preponderance of students desire highly specialized training. It might be that their interest is directed chiefly to toxicological problems, to general laboratory technique, to the special study of the examination of the blood, or of hairs and fibres. On the other hand their aim may be along the more clearly defined path of forensic pathology which, in turn, will lead them to the post-mortem room and matters of morbid and other histology.

In Glasgow, we do not provide facilities for post-graduate instruction in toxicology, apart from certain isolated fields, for example, the alcoholic content of blood and urine. When a request is made for such study, by arrangement with the City Analyst's Department, adequate facilities are afforded.

Very often on the completion of a course of post-graduate study, an overseas participant will ask for some form of written certificate of accomplishment, so that this may be produced to those who have sponsored this branch of education. Very often enquiry is made whether, after taking a full course of post-graduate instruction, a diploma will be granted. So far success has not be achieved in effecting such an arrangement. I do feel, however, that the creation of such an acknowledgment should be made possible, and I earnestly look to the future for its accomplishment.

Legal Medicine

Dr. G. Barber: A barrister recently remarked to me that doctors tend to make bad witnesses, firstly because they are so honest, and secondly because they tend to know so little about the legal side of medicine. If this is fair comment, then it should be the aim of those who teach legal medicine to the student to see that he is better prepared for his inevitable contact with legal machinery when he goes into general practice. I think that the student is too engrossed with the immediate prospect of examinations to realize how important his training in legal medicine will be to him when he becomes a general practitioner, for he is still at the stage of only considering the likelihood of a question in his final papers. Also, the general practitioner is unlike those who teach legal medicine; for them it is the whole or a large part of their professional job, whereas for the ordinary doctor a case which includes legal procedure almost invariably arises out of an emergency, an interruption which claims an absolute priority. He is therefore liable to be hurried and resentful, and in his attempt to get through with it as soon as possible, he forgets that he will be cross-examined at some distant date in the presence of people who have no conception of the actual events, and will be asked questions about his observations for which he must be prepared in the widest terms.

How can this be remedied? I firmly believe that teaching must be

dogmatic, but I also believe that personal experience makes the deepest impression. So that the teacher of legal medicine should aim at two things. He must impress the student of the absolute importance of what he is being taught, and I believe that he should start every lecture by saying: 'This situation, or something very similar, is one in which you are almost certain to be placed at some point, and unless you profit by my experience and remember how to handle the situation you will find yourselves bewildered at the time, and resentful later on at the perfectly justifiable cross-examination'.

At some point, also, the student should actually see for himself the procedure in a coroner's court, and a police court, where there is a case of 'drunkenness whilst driving', as these two are the commonest incidents that a general practitioner is likely to have to handle, and may serve as examples. But it is probable that in order to teach future general practitioners, the professor of legal medicine should himself review his own experience. He may know all about legal medicine, but nothing about general practice and, if this is so, then he will find that if he were to 'sit in with' a general practitioner friend for an occasional afternoon he could orientate his teaching so as to be of greater practical use, if he himself has first-hand knowledge of the kind of life which his students will be leading later on.

The State Medico-Legal Institute

Prof. A. I. Kayssi: I must thank you for this opportunity to speak about the development of legal medicine in my country. I shall deal with the broad outlines of some of the medico-legal teaching problems in Iraq.

It is the story of the creation and development of medico-legal practice in a country where such a thing was non-existent. It was at that time limited to autopsies and minor police cases dealt with by non-specialist medical officers employed in the government service and sometimes even by male nurses. It was common also for midwives to conduct the examinations in cases of suspected rape. What I have to say may perhaps be of some value to those who may have to start from scratch in similar circumstances.

In the autumn of 1932 I was appointed to the Directorate General of Police and required to perform various duties, some of them appertaining to the Police and others to the General Directorate of Health. These duties included: Physician to Civil Servants and to the Baghdad Police Force, Director of the Lunatic Asylum, Forensic Pathologist to the City of Baghdad, and Teacher of Forensic Medicine at both the Police School and the Royal Medical College, Baghdad.

The efforts expended during these first 3 years in performing such

manifold tasks were largely fruitless: I felt the burden of such a heavy moral responsibility and eventually I succeeded in convincing the authorities of the necessity of concentrating on one subject alone.

After a period of study in Edinburgh under Sir Sydney Smith and in Vienna and Pavia I returned home to start building up the Medico-Legal Institute. My first task was to obtain the confidence and trust of both the judiciary and the police and so it was with enthusiasm and energy that I exhaustively investigated every case presented to me. I was responsible for introducing for the first time the identification of blood and the determination of its species and group, introduced other laboratory procedures and was largely successful in stressing the importance of medico-legal work. A suitable building was eventually acquired in which to house the Institute together with an adequate staff to help me in realizing my ambitions in the cause of justice.

I restricted the duties of the Institute to the following:

1. Autopsies of medico-legal cases occurring in the city of Baghdad.
2. Laboratory examination of forensic material, e.g. blood, semen, fibres, etc. for the whole of Iraq.
3. Examination of human remains for the whole country.
4. Examination of cases involving sexual offences occurring in the city of Baghdad.
5. Providing medico-legal advice, and acting as a co-ordinating body to establish a cordial relationship between our Institute and the judiciary, investigating authorities and medical examiners.
6. Organizing medico-legal teaching.

The following figures give some idea of the type and volume of work undertaken by the Institute during the course of a year:

Autopsies	400 — 550.
Laboratory Examinations	
(Blood, Semen, Hair, Bones)	1,000—1,400.
Miscellaneous	
(Hymen, Sodomy, Age, etc.)	350 — 450.

We also deal with numerous enquiries and give advice in connexion with cases dealt with by others in various parts of the country, often visiting the scene of crimes. Routine training of the police and students of other colleges was also undertaken.

As a result we acquired a large mass of technical data, photographs and specimens which have proved of inestimable value in the training of our students. We invariably rejected any suggestion for increasing our authority or scope of work without the necessary increase in staff in order to maintain a high standard.

Toxicological examinations are still carried out by the Central Chemical Laboratory, all instructions regarding the preparation and handling of this material being subject to the advice of the Department.

Ultimately the Institute broke away from its original attachment to the

Police Department and came wholly within the orbit of the Health Department. This helped us greatly in getting technical assistance from sources within this department, enabled us to supervise the activities of its officials who were dealing with medico-legal cases (medical examiners) to co-ordinate our work with them and with the Royal Medical College which is also part of the Ministry of Health. The Director of the Institute holds the Chair of Forensic Medicine at this College.

All medico-legal work outside Baghdad is performed by medical officials as a minor part of their normal duties under the limited supervision and guidance of the Institute. They have to comply with the detailed instructions issued in the form of a pamphlet which is generally distributed, and I would like to mention the main points included therein:

We draw the attention of the medical examiner to the importance of his duties and his grave responsibilities while dealing with medico-legal cases. We advise him how to treat such cases, how to collect specimens and store them; to whom they should be sent; how to obtain the assistance of his superiors, and the means of contact with the Institute.

I would like to stress a point of special importance mentioned in the pamphlet with regard to sexual offences, especially rape and sodomy. You will notice the recommendations prevent the medical examiner from giving any decision in such cases. He is instructed to send these cases to the district Medical Board after a preliminary examination which may include the collection of specimens. The Institute may or may not be consulted.

In order to facilitate the medical examiner's task in dealing with medico-legal cases and keeping an acceptable standard of reports, the Ministry have issued official orders instructing these doctors to complete the medico-legal forms issued by the Institute. They have only to fill in the blank spaces.

With regard to instruction in this field the police and law students are given almost the same quality and quantity of teaching. In the case of the police, who normally are the first to come into contact with the crime, special emphasis is given to the following points: They have to know how to handle its various elements, i.e. the criminal, the victim and the scene of the crime; what to touch and what not to touch; what to look for; how to handle things seized, to whom to send them and what to ask for. Emphasis on the need for co-operation with the medical examiner is stressed and the necessity for the police to enlighten him about the circumstances of the case. This co-operation is essential if the best results are to be obtained. They must bear in mind that the medico-legal examination is not the matter of guesswork but of teamwork.

The law students require to know the extent and limitations of scientific methods and investigations; the significance of medico-legal conclusions whether these are directly or indirectly definite, or whether they are by exclusion or by presumption. By this method, amongst others, we try

to promote a sympathetic understanding between the judiciary and the medico-legal expert.

We found the teaching of this subject to medical students comparatively simple as they possess a good scientific background.

Forensic medicine is essentially a part of State medicine and it is high time that it should be considered as such. It is the duty of the State and the local authorities together with the universities to give serious consideration to this matter. I should like to emphasize that the academic pathologist is not of necessity a forensic expert. He may become so by embracing the philosophy of forensic learning and acquiring its spirit by devoting himself exclusively to its practice.

I would suggest that all universities should hold periodic post-graduate courses in Forensic Medicine which would include the study of toxicology and medico-legal psychiatry. Those students reaching the required standard should be granted a diploma. Not only would this raise the standard of learning and increase the number of experts available, but it would also encourage research in this field. In any case, I am sure you will agree with me that the State has a duty to make experts available in all districts in much the same way as the Medical Officer of Health is now available. Those appointed should be adequately compensated financially in a manner suited to their great responsibilities. The forensic expert is no less essential in the cause of justice than is the M.O.H. in the maintenance of public health.

The Significance of Foreign Bodies

In the Alveoli of the Apparently Drowned

H. S. Holden* and Surgeon Commander J. W. L. Crosfill, R.N.†

It has generally been accepted [1-3] that the presence of microscopic plant and animal remains, silt, coal dust or other particulate matter in the alveoli of a body found in water, is proof that life was still present when that body entered the water, and that an *in vivo* inhalation of the fluid medium and particulate matter must, of necessity, have taken place. Such a conclusion is based on the belief that fine particulate matter would not penetrate the smaller airways by permeation after death. The experimental evidence, as far as we can ascertain, on which this assumption is founded, is, in our view, inadequate. It is an assumption which could have, on occasion, grave forensic implications. Smith[1] records that particles failed to appear in the alveoli of a body left in water for 6 weeks with frequent moving, but gives no other experimental details. That particulate matter can find its way as far as the trachea is admitted by Smith[1] and Simpson.[2]

In our opinion there seemed no *a priori* reason why fine particulate matter in suspension should not be able to penetrate the bronchioles and so appear in the alveoli. We were not convinced that the barrier presented by an air-lock would be impassable to such particles, especially when penetration was aided by the various movements to which a dead body would normally be subjected when thrown or placed in the water, e.g. during the immersion, during the recovery of the body and later handling, or even deliberate attempts at artificial respiration. Although penetration might be small in amount and limited in distribution, once the possibility of its happening is admitted, or if it could be demonstrated experimentally, the evidential value of the finding of such foreign bodies in the alveoli of a cadaver would be nullified and it might no longer be possible to affirm that life had still been present when the body became immersed. The present investigations were therefore planned to determine, under laboratory conditions:

1. The depth of penetration of finely divided matter into the lungs in drowning and its presence, or otherwise, in the stomachs of the drowned animals.
2. Whether posture at the time of drowning had any differential effect on the penetration and dissemination of finely divided matter.

* Adviser in Forensic Science, Home Office.
† Royal Naval Personnel Research Committee.

3. Whether, under the conditions of the experiments, any penetration was detectable into the alveoli of animals killed by Nembutal or drowned in tap water and subsequently immersed in a suspension of finely divided matter.

Methods

Rabbits were used as the experimental animals. Initially highly ground purified sand (particle size 5 to 30 microns) was used, but as indistinguishable particles were found to be present in the stomachs of wild animals, Dicalite was chosen as the tracer substance for the experiments. 'Dicalite (L)' is a high grade diatomaceous earth supplied by F. W. Berk & Co. Ltd., consisting mainly of fragmented diatom frustules with occasional fragments of skeletal parts of Radiolaria and other siliceous spicules. It gave a silica figure of 94% and had a size range from 40 microns to less than 2 microns. It forms a milky suspension in water which persists longer than a week. It was ideal as a tracer substance in these experiments since it is unaffected by the digestion techniques employed and its appearances under the microscope are unequivocal.

Throughout the investigations the greatest care was exercised to avoid contamination of the pleura by the tracer substances. The thoracic contents were exposed by wide reflection of the thorax and removal of the ribs. The trachea and bronchi were ligatured with the help of aneurysm needles and the lungs were removed with the minimum of handling. They were washed superficially by a gentle stream of tap water both before and after separation of the right and left lungs by cutting above the bronchial ligatures. This care was necessary both to avoid accidental contamination of the surface of the lungs and to minimize the risk of squeezing the possible diatomaceous contents of the bronchus peripherally. The right lungs were placed in formol saline, the left in jars for later digestion analysis. The ligatured stomach was preserved additionally for digestion analysis.

In the digestion investigations portions of the lung were cut out and were immersed overnight in concentrated nitric acid in round-bottomed flasks at room temperature. They were then gently heated for some hours over a water bath until the lung tissue had dissolved and any mineral sediment present had been deposited at the bottom of the flask. This deposit, with a portion of the supernatant fluid, was then withdrawn and centrifuged. The concentrated deposit was pipetted off and examined microscopically. The stomach contents were submitted to a similar experimental procedure. The reason for using nitric acid alone as the digestive agent for the lung tissue was that this technique:

(a) Avoided the charring and extensive frothing which accompanies digestion in a mixture of equal parts of concentrated sulphuric and nitric acids; and

(b) Leads to far less surface etching of the mineral matter.

The animals used in Experiment 2 were killed by the injection of 5 c.c. of Nembutal into the ear vein. Before immersion a unilateral slit was made extending 1 inch into the cheek from the angle of the mouth. This was considered necessary as the oro-nasal cavities of the rabbit do not offer ease of entry of the suspension comparable to those of the human cadaver. An incision was also made in the abdominal wall to permit the escape of gases of putrefaction and to permit herniation of the distended viscera. This was thought desirable to avoid possible pressure effects on the diaphragm which might ensue from build-up of pressure and possible subsequent release which might in effect produce a pseudo-artificial inspiratory effect on the lung. The viscera, although distended by putrefaction, did not, in fact, herniate through what proved to be an inadequate incision. It was our opinion that the abdominal slitting had no effect on the results of the experiment.

The dead rabbits were lifted by the limbs and were placed gently in the tanks.

These were then removed to the laboratory roof where they remained undisturbed for a week. The cadavers were removed in a similar manner but all manipulations were carried out as gently as possible. The animals were thus subjected to far less mechanical disturbance than obtains when a human body is disposed of in water or experiences during its recovery and later autopsy. Thus our experiment was designed to minimize the chances of obtaining a positive result, whilst otherwise trying to conform to the human situation.

An arbitrary decision was made to leave the cadavers immersed for 1 week to allow time for quiet percolation, if it occurred, to take place. We felt, however, that if foreign bodies do enter the alveoli, they are assisted there by the effects of mechanical incidents at the time of immersion or recovery and that quiet penetration probably plays a minor role. To have carried out a full experimental cover would have meant the sacrifice of many animals, carrying out investigations at various intervals after immersion, and also experiments (very difficult to devise) where percolation alone might have been the only factor present. Had such a plan been adopted it would have had little validity as far as the real life situation is concerned in which the mechanical effects are unknown variants, whilst quiet percolation is an unreal situation. We contented ourselves therefore in answering the single query—can foreign bodies find their way into the alveoli? If they did so in the deliberately adverse conditions of our experiment it was reasonable to suppose that they might do so into the lung of a human cadaver immersed after death in water containing suspended foreign matter.

At the end of a week putrefaction had occurred in the animals to the extent that the muscles were pink-stained and occasional gas bubbles were seen in the tissues. The lungs were not fully collapsed and no gross macroscopic changes were apparent on the surface. A trace only of straw-coloured pleural effusion was present.

Experimental Details

Experiment 1: (a) To determine the depth of penetration by foreign bodies when animals are drowned in a suspension of such material.

(b) To determine whether there is a differential dissemination of foreign bodies related to the position of the animals at the time of drowning.

The rabbits were drowned in 3 positions, vertically head upwards, vertically head downwards, horizontal supine. Three tracer substances, fine sand, Dicalite and builders' coarse sand were used. The builders' sand did not form a suspension but was poured into the tank in a steady stream during the drowning.

No attempt was made to estimate the concentration of the suspension in this or subsequent experiments. A dense concentration was always used.

Results

Table 1 summarizes the findings. Sections showed that the penetration of all the lobes of the right lung was complete in all cases, irrespective of

the tracer used or the position of the animal at the time of drowning. Even the marginal alveoli were heavily contaminated with tracers and this dense 'stuffing' of all areas of the lung fields did not permit any differential appreciation to be made (Fig. 3).

The naked-eye appearances immediately on opening the thoracic cavities were those of intense, patchy pleural congestion over the basal lobes extending postero-basally. This finding was constant irrespective of the position of the animal during drowning.

In those animals drowned vertically but head downwards there was a similar area of patchy congestion over the apical portions of the lung, present only in those animals drowned in this head-down position.

In the animals drowned in the horizontal position only postero-basal congestion was apparent, the appearances being indistinguishable from those seen in the animals drowned head vertically upwards.

These areas of congestion faded appreciably during the first 5-10 minutes but did not disappear entirely. They correspond to the capillary engorgement and sub-pleural haemorrhages seen microscopically in drowning.

It was concluded that the result of placing the upper bronchus vertically downwards during drowning was to allow more water to enter that bronchus than occurred when only an inspiratory influx was present in the vertically upward position. This gravitational facilitation resulted in the apical portion of the lung (now the lowest portion) taking more of the brunt of the drowning mechanics. That the lower lobes always showed marked congestion irrespective of the position of the rabbit during drowning is thought to be related to the overwhelming effect of the wider bronchial approach

Table I

Rabbit	*Position During Drowning*	*Tracer Substance*	*Lobe Examined*	*Particle Penetration*	*Congestion Visible (+) or not (−)*
No. 1	Head down	Fine sand	Rt. Apical	Massive	+
			„ Basal	Massive	+
			„ Postcaval	Massive	−
No. 2	Animal horizontal	Fine sand	Rt. Apical	Massive	−
			„ Median	Massive	−
			„ Basal	Massive	+
			„ Postcaval	Massive	−
No. 3	Head up	Fine sand	Rt. Apical	Massive	−
			„ Median	Massive	−
			„ Basal	Massive	+
			„ Postcaval	Massive	−
Nos. 4, 5, 6.	All positions	Coarse sand	As above		As for 1, 2, 3.
Nos. 7 8, 9.	All positions	Dicalite	As above		As for 1, 2, 3.

and the ease of relatively massive water influx not needed to be diverted into a secondary side channel. No appreciable differences were present between the animals drowned horizontally and vertically but head upwards.

Experiment 2: To determine whether diatomaceous fragments could be found in the alveolar spaces of rabbits killed by Nembutal and subsequently immersed for 1 week in a suspension of Dicalite (L).

Three rabbits were killed by the injection of 5 c.c. of Nembutal into an ear vein. A unilateral incision 1" long extended the mouth into the cheek to allow freer access of the suspension and to simulate the free access of the human oro-nasal cavities after death. The abdomens were slit as previously described. Five minutes were allowed to elapse after apparent death to ensure that no vital respiratory inhalation could be made after immersion. That life was really extinct was confirmed by the absence of any bleeding or reflex activity when making the incisions.

Results

Table 2 summarizes the findings.

Table II

Rabbit	*Lobe (Rt. Lungs)*	*Number of Sections Examined*	*Histological Findings*	*Digestion technique (Left Lungs)*
No. 10	Apical	2	− −	Negative
	Median	2	− −	
	Basal	2	+ +	
	Post-caval	1	−	
No. 11	Apical	2	+ +	Negative
	Median	2	− −	
	Basal	2	+ +	
	Post-caval	1	−	
No. 12	Apical	2	− −	Negative
	Median	2	− −	
	Basal	2	− −	
	Post-caval	1	− −	

Thus in two rabbits out of 3 alveolar foreign bodies were found in the right basal lobe and in one of these rabbits they were present in the apical lobe also. The diatomaceous fragments found were very scanty and only one or two such small agglomerations as are shown in Fig. 1 were found in each section. No fragments were found in marginal alveolar spaces; those seen were central with regard to the section but it was not possible to suggest their relationship to any adjacent bronchiole. No diatomaceous material was seen in any of the bronchioles themselves. Examination of the section as a whole confirmed the absence of the appearances found in drowning and no evidence of microtome drag was present. It is necessary to exclude both these factors which might otherwise account for the

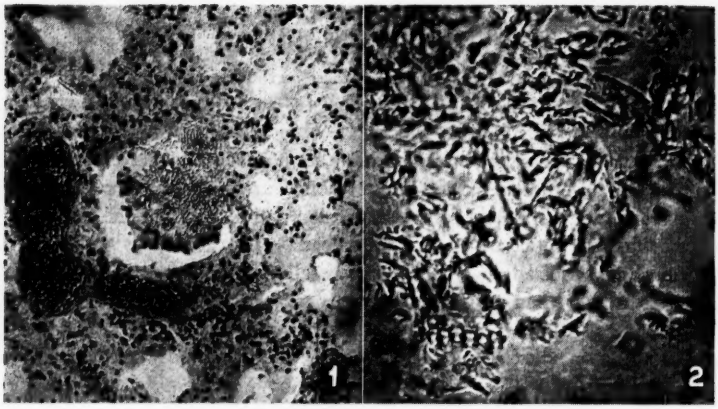

Fig. 1. Portion of lung section from rabbit immersed in aqueous suspension of 'Dicalite' after death showing local penetration of suspended matter (× 120).
Fig. 2. Part of the same section more highly magnified. Note the radiolarian fragment on the left of the figure (× 500).

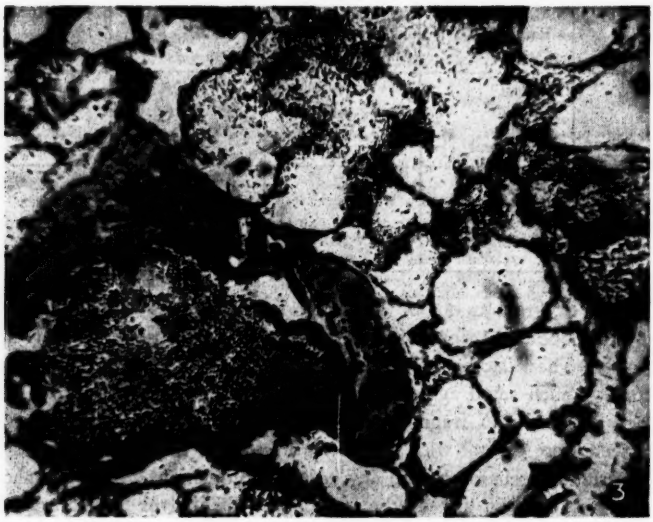

Fig. 3. Portion of lung section from rabbit drowned in water containing Dicalite in suspension showing heavy and generalized penetration of suspended matter (× 250).

presence of fragments in the alveolar spaces. Neither was any pleural contamination observed microscopically. It is concluded that the histological appearance of particulate matter in the alveolar spaces can be found when rabbits already dead are subsequently immersed in diatomaceous water, and that whatever be the mechanism by which these particles appear in the alveoli, even if this be error in experimental technique, it cannot be stated in evidence that their presence implies that life was not extinct when the body entered the water.

Only the right lungs were examined histologically, the left lungs being examined by digestion techniques with which method negative findings were obtained in this experiment. This is not surprising when the very scanty traces of diatomaceous material seen in the sections is considered. Had it been possible to examine the lung tissue as a whole and yet exclude the bronchioles and larger airways, a positive result might have been achieved but in practice this is not possible and only snippings of the lung can be taken. The histological examination is definitely superior in the case of experimental animals but the difficulties of histological examination of the human whole lung are obvious and the larger the lung the more feasible it is to obtain scientifically acceptable snippings and so to include more alveolar tissue and the chances of a positive finding. The forensic implications of this experiment will be discussed in a later paragraph.

Experiment 3: To determine whether diatomaceous fragments would pass into the alveolar spaces of rabbits just drowned in pure tap water and subsequently immersed in Dicalite (L) suspension for 1 week.

An experimental routine parallel to that of Experiment 2 was adopted except that the aniamls were first drowned in laboratory tap water instead of being killed by Nembutal, care being taken to use tanks free from possible diatomaceous contamination. Three rabbits were again used. It was thought that the fine persistent frothy albuminoid barrier occasioned in the bronchioles by drowning in tap water might present a more effective barrier to penetration than the presumed air-lock of the rabbits killed by Nembutal.

Results

No diatomaceous material was found in the lungs of these 3 rabbits either histologically or by the digestion technique.

This experiment served as a useful check on the experimental technique in that absence of secondary contamination of the sections from either pleura or trachea and bronchi is confirmed by the negative findings of this experiment (and also of rabbit No. 12 in Experiment 2).

Experiment 4: To determine whether the results of Experiment 2 could be repeated when rabbits, previously killed by Nembutal, were subsequently immersed for 1 week in a tidal creek.

Three rabbits were killed by 5 c.c. of Nembutal injected into the ear vein and were subsequently immersed in cages in a tidal creek so that the

cages became awash at low water and were exposed to the turbulence effects of the tide on the muddy and sandy bottom.

The findings were compared with those in 3 rabbits drowned at the same site.

Results

The rabbits drowned in the creek showed disseminated detritus throughout the lung fields with occasional but very scanty refractile particles. No such appearances were seen in the animals previously killed and immersed subsequently.

With the acid digestion technique, examination of the left lung of 3 rabbits drowned as controls in Experiment 4 gave negative results. Positive results were however, obtained when an alternative technique, using papain digestion, was employed as described below.

An Alternative Digestion Technique

It will have been noted that, in the foregoing experiments, a suspension of practically entirely siliceous material was used. The use of this material was largely governed by the desire to use a simple and easily reproduced technique, but it was also influenced by the use of concentrated nitric acid as the agent of digestion. It will be obvious that the technique employed has the disadvantage that any calcareous material and any other substances susceptible to attack by strong nitric acid would be partly or wholly destroyed.

Since it is probable that, under natural conditions, such materials would be likely to occur in the lungs of drowned persons, the possibility of alternative techniques of tissue digestion were explored and promising results were obtained by the use of a suspension of papain.

For this purpose samples of lung tissue from the control animals were ground with papain in a mortar in a quantity sufficient nearly to fill the flask used and adding a trace of sodium cyanide solution. The flask was stoppered and incubated at 37° C. for 4 days, any traces of remaining tissue being then decanted off and the residue consisting of mineral matter washed and retained.

Although this technique did not yield so clean a deposit initially as that using nitric acid, adequate washing and centrifuging proved quite satisfactory. With one group of rabbits used during the course of Experiment 4 the enzyme technique has yielded positive results when the acid digestion technique has given negative findings. In this particular instance the rabbits were drowned in a salt-water creek in which suspended debris was small in amount and different in composition, and where this is likely to be the case it would appear to be the method of choice.

It should be pointed out that, whatever technique is used, a centrifuged deposit of the material in suspension in the water from which a body has been removed should be submitted to precisely the same technique as that to which lung tissue has been subjected in order to yield comparable results.

Although in our experiments this precaution might have been regarded as unnecessary it was observed as a matter of routine.

Discussion

Experiment 2 indicates that it is possible for foreign particulate matter to appear histologically in the alveolar spaces of rabbits killed before immer-

sion in water containing such foreign particles, and that the alveolar presence of these particles is not therefore proof that life was still present, i.e. that an inspiration had occurred, whilst the body was in the water. We consider that the movements to which the dead body is subjected whilst in the water, or afterwards whilst the trachea contains water and foreign bodies, are capable of achieving penetration of the bronchiolar airways by finely divided particulate matter. Possibly a pseudo-artificial respiratory inhalation is produced or at autopsy the bronchial contents are squeezed along the airways peripherally. In a grossly putrid lung the movement of fluid through the lung and pleura might also facilitate this transfer of particulate matter.

Obviously the amount of foreign matter so displaced will vary with the varying degree of mechanical disturbances or manipulation to which the body or the lungs are subjected, but the chances of finding any such material will also depend on the density of the suspension in which the body is immersed. Even with the very dense suspension used in Experiment 2, only scanty penetration was found and such a dense suspension is not likely to be met in a real life situation unless perchance a body were found in an industrial vat or similar circumstances. At the same time a body frankly drowned is not likely to show more than an occasional particle in the lung fields unless the drowning had taken place in turbid water. When a lung section is found to contain a mass of detritus and particulate matter generally disseminated throughout the lung fields, including marginal alveoli, it is safe to assume that this was a vital phenomenon and a true inhalation had taken place. But if only scanty foreign material is present in the lung section no conclusions can be drawn in the light of our results in Experiment 2. If it is known that the water in which the body was actually immersed did contain a dense suspension of foreign material, then the scanty presence of such in the lung might suggest that a breath had not been taken whilst immersed. Thus only when the lung is uniformly penetrated by foreign bodies can a positive opinion be expressed about the presence of life at the time of immersion. When only scanty foreign bodies are present no opinion can be expressed on the basis of their presence only. Even if the victim had been drowned in a heavy suspension (such as might occur in industry) it is by no means essential that the lung should contain a massive penetration since death from 'shock' might have occurred without any inspiratory effort under water. In this, and indeed in all histological opinions on the lungs of such victims, the normal histological appearances of drowning must be sought for and considered apart from the presence of foreign bodies.

The findings in Experiment 1 are suggestive only, but might have important forensic implications if the results obtained in rabbits are repeated in the human. It is suggested, for example, that if a new-born child were drowned either accidentally or deliberately in the head-down position,

it might be possible to suspect this from the findings of apical congestion at autopsy and so cast doubt on any story that the child had been found 'lying' in water. But more observations are required before the tentative suggestion of this experiment in animals can be accepted as valid for man.

The result of Experiment 3 is interesting and might be of forensic importance where a body had been drowned in clear water but was subsequently recovered from a stretch of water dense in suspended matter. Unfortunately, whether or not such suspended matter will penetrate the alveoli must depend to a great extent on the mechanical disturbance of the body and it cannot be assumed that such a penetration would necessarily be present in every case even without the presence of an albuminoid froth barrier. One rabbit in Experiment 2 gave negative findings. Moreover it cannot be asserted that the froth barrier produced by drowning is in fact impermeable. That it was so in Experiment 2 is no guide to what might happen if comparatively more mechanical disturbance, such as attempts at artificial respiration, were involved. All that can be deduced from our experimental results is that it is less likely for foreign bodies to penetrate the froth barrier produced by drowning than if only an air barrier is present.

In conclusion, therefore, we consider that no firm opinion can be expressed from the presence of foreign bodies in the lung, whether life was or was not present when the body became immersed unless there is a wide, generalized dissemination of foreign material in the lung fields. This finding will not be present unless the body was drowned in water with a suspension of some density.

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Alcoholism: Some Medico-Legal Aspects*

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Although the literature abounds with material dealing with driving under the influence of alcohol, a subject not dealt with in this paper, there is a serious dearth of scientifically validated articles concerned with the extremely vexed question of the correlation between alcohol consumption and serious crime.

Many prominent people, of whom temperance workers are in the fore, have made statements to the effect that 80-90% of crime is directly attributable to the ingestion of alcohol. Important aspects which are all too frequently ignored when such statistics are quoted are:

(*a*) That both alcoholism and anti-social behaviour are determined by the reciprocal action of a number of somatic, social and psychological factors. Adverse social conditions may be an influential factor in producing both criminal behaviour and excessive alcohol consumption. Thus alcohol addiction and crime may well both be symptomatic of a social maladjustment without the one necessarily being the parent state to the other.

(*b*) In any specific case under discussion it is important to decide whether it is a question of the ingestion of alcohol resulting in crime, or merely a question of a criminal taking alcohol.

(*c*) It is a well-known fact among prison visitors that criminals occasionally deliberately take alcohol to enable them to commit crime by releasing their emotions from the restraint of reason and judgment. In fact the intent was present before the actual ingestion, and thus the taking of alcohol was not in effect a causal factor in the criminal manifestation, but only a means of dampening inhibition sufficiently to allow the commission of the act.

Curt Amark[1] in a study in 1944 in Denmark claimed that criminality was about four times as prevalent in the alcoholic sample studied by him as compared to that in the general population. He also makes the statement that the abuse of alcohol makes its appearance chronologically earlier

* A paper contributed to a symposium on *Alcohol and Crime* and read at a meeting of the South African Medico-Legal Society, Johannesburg.

in the criminal alcoholic group than in the non-criminal control group. The fact that the studied group indulged in behaviour not in keeping with the norm obviously lends itself to speculation about how great a proportion of his specimen group was so socially maladjusted as to have embarked on a criminal career even without the assistance of alcohol!

Sir Norwood East[2] has remarked: 'Many offences are assumed to be due to alcohol on insufficient grounds. There is often no evidence to show that the accused would not have committed the act had he been sober.' This to my mind is a matter of paramount importance, and a full and complete investigation into an individual's previous history should be instituted before a claim of cause and effect is accepted. Previous criminal behaviour manifested by a person when sober, will tend to minimize the role of alcohol in the causation of any subsequent crime where alcoholism is claimed as a defence.

Nevertheless, there is sufficient factual basis for holding that there is a definite relationship between crime and alcohol, especially with respect to certain types of crime.

Amark[1] has, in his analysis, shown that in the alcoholic criminal community as compared to a broad sample in the criminal male population:

(i) A 'complicated criminality' is more common in the alcoholic criminal, i.e. he may indulge in different types of crime more commonly than a member of the prison sample. He found in effect that in the non-alcoholic prison sample the criminal usually 'specialized' in one particular type of crime, whereas the alcoholic criminal did not limit himself, but at different times his activities covered a wide variety of different types of criminal behaviour.

(ii) Crimes of violence are proportionately twice as frequent in the alcoholic criminal as compared to those occurring in his male criminal non-alcoholic sample.

Both the indirect and direct effects of alcohol in relation to crime must be considered.

A. The Indirect Effects

1. Many workers have stressed the prevalence of alcoholism in the parents of juvenile delinquents. Sheldon and Glueck[3] found that 37.5% of their juvenile delinquents come from homes in which either one or both parents drank excessively. Studies by William Healy[4] showed that, in three series of 1,000 cases each, in major American cities visited during his study of juvenile delinquency, alcoholism was present in the home in 31%, 26.5% and 51% respectively.

2. Chronic alcoholism often results in the lowering of the standard of living of the entire family unit, as well as that of the individual person. This does not apply merely to material considerations, but ethical standards

drop and social taboos lose their significance. A favourable nidus for the development of criminal activity is a more than possible outcome.

B. The Direct Effect

When considering the direct effects of alcohol on crime, a distinction must be made between criminal behaviour on the part of a person who has taken alcohol and shows only the ordinary expected symptoms of his indulgence, and that of those whose manifestations can be considered to be pathological.

There are four conditions—one a physiological, and three pathological responses, which may be cited as a defense in a charge of serious crime. These are:

1. Acute Intoxication.
2. The Alcoholic Palimpsest.
3. Pathological Intoxication.
4. Pathological Intolerance to Alcohol.

Acute Intoxication

It may be as well in order to understand better the behaviour of a person who is under the influence of alcohol, and indulges in criminal activity, to describe briefly the physiological action of alcohol on the individual.

From the outset alcohol acts as a depressant of the central nervous system. It removes controlling or inhibitory functions by this depressant activity. Those functions which are most recently developed in the evolution of man appear to be most susceptible to the effects of ethyl alcohol, while the more primitive functions are more resistant and require a higher concentration to eliminate them. At first there is usually a feeling of increased well-being and heightened confidence. Behaviour becomes less restrained, self-criticism and judgment become impaired, cognition is ablated and reasoning powers are more or less seriously interfered with. The individual often becomes garrulous and incautious. Impulsiveness and emotional lability are common features. All these manifestations are due to the narcotic effect of ethyl alcohol on the centres responsible for the functions of inhibition, self-criticism, judgment and reasoning, which are in reality functions learned by the individual. The more fundamental the degree of learning, or the stronger the impact of social law upon the individual, the less likely is he to indulge in anti-social behaviour while under the influence of alcohol.

Soon after the development of the psychological manifestations described, physical symptoms make their appearance. Inco-ordination, first of the fine movements and later of grosser movements, becomes evident. Nystagmus occurs. The gait becomes staggering. The finger-to-finger test becomes abnormal; this is a good test of inco-ordination due to the action of alcohol. A positive Romberg sign develops. Speech is slurred or slow and staccato.

Blurring of vision and diplopia may next be experienced, together with difficulty in focussing. Reflex centres are depressed and as a result the reaction time of reflexes is increased. Pupils are at first dilated and later contracted, but at all times react sluggishly to direct light. Drowsiness and sleep may ensue.

While all these signs and symptoms are directly due to the narcotizing effect of ethyl alcohol on the central nervous system, signs due to effects on other systems make their appearance. There is a peripheral vaso-dilatation resulting in the well-known ruddy complexion and suffusion of the conjunctiva. The pulse is rapid. There is a drop in temperature due jointly to the central depressant effect and the peripheral vaso-dilatation.

In the diagnosis of a person alleged to be under the influence of alcohol, chemical analysis is becoming ever more important. In some countries stress is laid entirely on this means of diagnosis and specific blood alcohol concentrations have come to be interpreted as being directly correlated with the degree of intoxication where alcohol is alleged to be instrumental in causing criminal behaviour.

To anyone having experience of the treatment of alcoholism, the dangers inherent in this practice are obvious. Tolerance to alcohol varies from individual to individual. One person who has not become adjusted to the insult will be incapable of performing set tasks with a blood alcohol concentration of as little as 1 mg. per c.c., whereas the heavy drinker will show no ill effect whatsoever at this level.

The level of impairment of functions with different blood concentrations differs not only from individual to individual but also in the same individual from time to time, depending on a number of undefined endogenous and exogenous factors.

Thus it is a well-known fact that, during a drinking period, an individual may have more objective and subjective signs with a lower blood alcohol concentration soon after taking a few drinks, than he has later with a higher level. This is due to the process of adaptation on the part of the central nervous system, which is in effect, a process of adjusting and getting used to a new set of circumstances under which it is to function. A further practice of attempting to correlate the blood alcohol level with the amount of alcohol taken is basically unsound, for the following reasons:

(i) The rate of absorption of alcohol is directly related to state of digestion and the stomach contents at the time of ingestion.

(ii) It is common knowledge that the alcoholic reaches a stage where his capacity to carry alcohol diminishes quantitively. He finds that whereas previously he could drink much more than his friends without showing undue effects, he now becomes intoxicated on relatively small quantities of liquor. This state is probably due to liver damage and a consequent inability to metabolize alcohol—the liver being the only organ in which alcohol is broken down. Subsequently more alcohol will pour into the

blood stream in its original form as break-down functions are impaired. Thus small amounts of alcohol taken result in abnormally high blood concentrations. A combination of the chemical test results and the results of a thorough physical examination, preferably repeated on the following day to rule out the possibility of the symptoms noted having been due to concurrent diseases, must be the best and only reliable method of assessment. A standard set examination form should be developed by a panel of experts so that the diagnosis of 'under the influence of alcohol' would become more uniform and objective.

Sir Norwood East[2] has pointed out that 'even the ordinary culpable drunkenness may have the effect of diminishing criminal responsibility in that it may disprove the ordinary inference which otherwise would be attributed to the conduct in question. Thus it may produce such a mistake of fact as will in itself diminish the culpability of an unlawful act. For instance, a man's drunken compulsion of mind may lead him to think that others are threatening to assault him and he may attack them in supposed self-defence (*Reg.* v. *Gamlen,* IF 2 F 90 K S C 54)'.

As already stated a decrease in the power of cognition, inhibitory powers, reasoning and judgment occurs in a person who has taken liquor. Consequently, crimes committed due to this state of mind should have a particular stamp. Assault is the commonest misdeed resultant mainly on a false evaluation of situations and easily provoked indignation. Petty theft is not uncommon, but in all crimes committed while under the influence of alcohol, one finds that:

(*a*) The degree of intelligence used in the commission of the crime is far below that of which the particular criminal is capable.

(*b*) Little or no attempt has been made by the accused to hide the fact that he had committed a crime.

(*c*) The degree of gain is negligible.

Meggendorfer[5] in discussing alcoholic psychosis states:

'That acute alcohol intoxication is not designated as a mental disorder is simply due to a tacit agreement because of the consequence which such a designation would involve. In reality the acute alcoholic intoxication is a poisoning of the brain, and can be placed side by side with the severest mental disorders.'

Immanuel Kant[6] observed: 'Drunkenness is the unnatural state of inability to organize sense according to the laws of experience'. If this is accepted present ideas of responsibility in relation to intoxication must be revised drastically.

The House of Lords in 1920 ultimately defined the law on this subject in England. It declared:

i. Insanity, whether produced by alcohol or otherwise, is a defence to the crime charged.

ii. Evidence of drunkenness which rendered the accused incapable of forming the specific intent essential to constitute the crime should be taken into consideration with the other facts proved in order to determine whether or not he had the intent.

iii. Evidence of drunkenness falling short of a proved capacity in the accused to form the intent necessary to constitute the crime and merely establishing that his mind was affected by drink so that he more readily gave way to such violent passion, does not rebut the presumption that a man intends the natural consequences of his act.

iv. The test of criminal responsibility is not the same in cases of drunkenness as in the case of insanity and upon a plea of drunkenness where insanity is not pleaded the jury should not be asked to consider whether, if the accused knew what he was doing, he also knew that he was doing wrong.

To quote South African authority on the subject, Mr. Justice Ramsbottom[7] in case *R.* v. *Vermeulen* said: 'The effect of intoxication upon liability for criminal conduct has often been discussed. In *Rex* v. *Bourke,* 1916 T.P.D. 303, Wessels, J. considered the authorities and said: 'From the various authorities I gather the following general propositions with respect to the influence of drink upon the criminal:

(1) That, as a general rule, drunkenness is not an excuse for the commission of a crime, though it may be a reason for mitigation of punishment;

(2) If the drunkenness is not voluntary and is severe, it is an excuse—that is, if the drunkenness was caused not by the act of the accused but by that of another, and was such as to make him unconscious of what he was doing, then he would not be held in law responsible for any act done when in that state;

(3) If constant drunkenness had induced a state of mental disease, delirium tremens, so that, at the time the criminal act was done, the accused was insane, and therefore unconscious of his act, he is not responsible, but in such a case he can be declared insane;

(4) Where a special intention is necessary to constitute the particular crime, as for instance, express malice to make homicide murder, then drunkenness reduces the act from a more serious crime to a less serious one'.

This summary of the authorities was approved in *Rex* v. *Ngobese,* 1936 A.D. 296. See also *Rex* v. *Innes Grant,* 1949 (1) S.A. 753 at p. 765 (A.D.).

It is clear, I think, that drunkenness is not, in general, a defence to a charge of theft. It is perfectly possible for a drunk man to take the goods of another with the intention of depriving the owner of his ownership; the consumption of alcohol, even though it has reduced him to an advanced state of intoxication does not necessarily deprive him of the capacity to form the intention to steal. It may be, in some cases, that a man forms an intention to steal because he is drunk and yields to a temptation which he would have resisted had he been sober. The fact that he was drunk will not prevent his act from being criminal. But it is also clear that when a man takes the goods of another without the intention to steal he does not commit theft.

A sober man may take a thing in the mistaken belief that he has the

owner's permission to borrow it, or even as an unauthorized borrowing with the intention to return it; in none of those cases does he commit theft. Similarly, a drunk man may, by reason of his intoxication, take the property of another in the mistaken belief that it is his own; or he may remove the goods of another without any intention at all and simply because he was so drunk that he did not know what he was doing. In neither of these cases does he commit a theft. It is a question of fact in every case, whether the accused was drunk or sober when he took the goods—did he have the intention to steal?

The nature of the inquiry was described by Schreiner, J.A., in *Rex* v. *Taylor*, 1949 (4) S.A. 702 (A.D.) in the following passage (at p. 713):

'The ultimate inquiry is whether the Crown has in all the circumstances proved beyond reasonable doubt that the accused had the intent in question at the time when he did the act; but the presumption, on reasonable assumption, that a man intends the natural consequences of his acts must lead, ordinarily if not invariably, to the conclusion that an accused person who was capable of forming the relevant special intent did in fact form it before or when he did the act. It is not necessary for the decision of this case to exclude the possibility that, in exceptional instances, although the Crown has proved that a person affected by drink was capable of forming the requisite intent, it may yet, in the light of all the circumstances fail to prove that he did have the intent which his act would establish in the case of a sober person. This possibility was not canvassed in argument and it is sufficient for present purposes to say that in the case of a person charged with murder who is proved to have the capacity to form the intent to kill, although he was affected by liquor even to an extent that might justify the description of him as drunk, the decision of the question whether in fact he had that intent will ordinarily proceed along the same lines as if he had been sober.'

That statement was made in relation to the intention to kill in murder, but it is, I think, applicable to the case of the intention to steal in theft.

The 'ultimate inquiry' is whether the Crown has proved that the accused, though drunk, intended to steal. If he was so drunk that he was incapable of forming the intention to steal, he did not form it; if he was capable of forming the intention to steal, 'the decision of the question whether in fact he had that intent will ordinarily proceed along the same lines as if he had been sober'.

I have no doubt that the onus of proving the accused had the intention to steal is on the Crown. It was so held in *Rex* v. *Steyn* (1946 T.P.D. 169), in which *Rex* v. *Ndhlovu*, 1945 A.D. 369 was applied. In *Rex* v. *Kaukakani* (1947 (2) S.A. 807 A.D.) Davis, A.J.A., expressed the opinion that the onus should be on the accused in a defence of drunkenness. But the question which fell to be decided in that case was whether the onus of proof lay where the defence was insanity, and all that the case decided

was that where insanity was pleaded the onus of proving insanity was on the accused. It is true that Davis, A.J.A., in arriving at his decision, argued from the analogy of a defence of drunkenness, in which he thought the onus was on the accused, but I do not read the case as deciding that where a specific intent is an essential element in a crime which must ordinarily be proved by the Crown the onus shifts to the accused if he seeks to rebut the Crown case by saying that he did not have that intent because he was drunk. In *Rex* v. *du Plessis,* 1950 (1) S.A. 297 (O), where the defence was that the accused had had a fit causing a 'black-out', de Beer, J.P., said that for the purpose of the case he was disposed to accept the proposition that the onus of proof should be placed on the accused where he pleads either intoxication or insanity; placing the onus on the accused, the Court held that he had discharged it. It is not clear to me how the question of drunkenness arose in that case; a 'black-out' would appear to indicate mental disorder—even though temporary—and drunkenness was not relied on as a defence. In *Rex* v. *Innes Grant,* 1949 (1) S.A. 753 (A.D.) Centlivres, J.A., at p. 765 said:

'What the authorities describe as voluntary drunkenness may be relied upon by an accused to show that in committing the act charged against him he did not have the specific intent, which is a necessary element in the crime alleged to have been committed by him. In so far as what was said by Davis, A.J.A., in *Rex* v. *Kaukakani* may be construed as indicating that when an accused alleges that, owing to drunkenness, he did not have that specific intent, the onus is on him to negative that intent, the case may require revision in view of the well-recognized rule that the onus lies throughout on the Crown to prove all the allegations in the charge which are necessary to constitute the crime alleged.'

In *Rex* v. *Taylor,* 1949 (4) S.A. 702 (A.D.) Schreiner, J.A., who delivered the judgment of the Court, said (at p. 712):

'The first issue is whether the applicant had the intention to kill or whether the crime was not murder but culpable homicide. The second is whether extenuating circumstances were present. On the second issue it is not in dispute that a burden rests upon a person found guilty of murder to convince the trier of fact on a balance of probabilities that extenuating circumstances exist (*Rex* v. *Lambete,* 1947 (2) S.A. 603). On the first issue the question was discussed in *Rex* v. *Kaukakani,* 1947 (2) S.A. 807 and *Rex* v. *Innes Grant,* 1949 (1) S.A. 753. As the present case is one of murder, proof of the intention to kill (the scope of which was discussed in *Rex* v. *Valachia and Another,* 1945 A.D. 826) is part of the Crown's case. I agree therefore with the view indicated in Innes Grant's case at p. 765 that the onus of establishing that the applicant was not by reason of the amount of liquor that he had consumed incapable of forming the intention to kill rested upon the Crown.'

I think this is clear authority for the proposition that the Crown must

prove the existence of the essential specific intent in a case where the defence is that the specific intent was absent by reason of the intoxication of the accused.'

The Pathological Alcoholic States

The pathological alcoholic states next to be discussed are those in which an abnormal response to alcohol is present. The effects of the toxin on the individual are different from those ordinarily expected.

1. The Alcoholic Palimpsest

A condition not infreqently seen amongst alcoholics and occasionally in the non-addictive drinker is the sudden onset of behaviour resembling the 'black-outs' in anoxaemia.[8] I have seen many authentic cases of this type but none in my experience who had committed crimes during the phase. After only moderate ingestion, without showing any signs of intoxication, the person may carry on conversation and perform fairly well-organized and elaborate acts purely on an automatic level with indications only of patchy vague memory at intervals during this period of amnesia on the following day. This patchy amnesia which is not associated with unconsciousness has been called by Bonhofer the 'alcoholic palimpsest'.[9] The condition has been well described by the Alcoholism Sub-committee of the World Health Organisation's Expert Committee on Mental Health.

One patient of my acquaintance recently presented himself for treatment because of the onset of this symptom. Just before admission he had left an hotel, apparently perfectly sober, with the intention of driving home to the northern suburbs for dinner. About 4 hours later he found himself in the Northern Transvaal having safely traversed the traffic of Johannesburg and Pretoria at its peak hour. He had no recollection beyond a point where he had dropped a friend on his way home.

Where this type of automatic behaviour operates without the censure of cognition, the individual may react to stimuli in a fashion foreign to his 'normal' behaviour pattern. It is not inconceivable that a person functioning automatically without the assistance of a censor, which allows him to be aware of and judge his actions, may well respond to primary urges and instincts without inhibition. In this state the patient may respond to the so-called irresistible impulse—irresistible by virtue of the fact that, due to his condition he is unable to bring recognition, recall and subsequent evaluation of the act and its consequences, to bear at the moment of operation of the impulse.

Any type of crime could conceivably occur in this state, but because of the complete dissociation in time of the period of amnesia from his ordinary life, the crime would have no connection with his life when he was in a state of normal cognition. Therefore, e.g. a man who murdered his business partner whom he had been systematically robbing was prob-

ably not suffering from the condition at the time. Had there been no previous history of difficulties in the relationship and the attack had taken place in inopportune circumstances following an argument, and the accused was a known alcoholic, the possibility of the alcoholic palimpsest should at least be considered.

An extremely interesting and important point was raised in discussion by Dr. H. A. Shapiro. He indicated the close objective resemblance between the syndrome described as the alcoholic palimpsest and the hysterical fugue. In the individual case clinical acumen and experience will be the important factors in differentiation, but in general the following points of difference may be quoted:

(*a*) The alcoholic palimpsest is by no means rare in the alcoholic population, whereas hysterical features are no more evident in the alcoholics as compared to the incidence in the general population.

(*b*) As opposed to the hysterical fugue, behaviour during the period of amnesia is in keeping with the general personality manifestations of the patient.

(*c*) The hysterical fugue may be generally considered as being precipitated by some sharply imposed emotional strain. This factor is definitely not operative in the alcoholic palimpsest.

(*d*) The previous history of the hysteric who shows a dissociation of consciousness and subsequent amnesia will in most cases demonstrate structural personality defects and a predisposition toward hysterical manifestations. The alcoholic palimpsest on the other hand, can and does occur in any alcoholic irrespective of previous history or maladjustment.

(*e*) The duration of the palimpsest is always limited to that period in which the alcohol consumed is expected to be physiologically operative. There is always a relatively rapid and spontaneous return of memory.

In a recent article in the *Journal of Forensic Medicine* mention was made of how easy and tempting it would be for any criminal who had had some drink to claim an amnesia for the period in which he indulged in criminal activity. I feel that, given an opportunity for observation over a sufficiently lengthy period, the psychiatrist will in most cases be able to differentiate a true from a simulated amnesia.

2. Pathological Intoxication

This condition differs qualitatively rather than quantitatively from ordinary acute alcoholic intoxication. The characteristic toxic symptoms of alcoholic ingestion such as inco-ordination, slurred speech and diplopia are usually absent, but occasionally the pathological reaction may occur after the objective symptoms of intoxication have passed. A factor often missed but of considerable importance in the diagnosis of this condition, particularly when the condition is used as a defence, is the manifestation of the

rigid pupils in response to bright light, as reported by many workers. This is claimed by some to be the only constant neurological sign present and is said to last long after the mental symptoms have passed.

In those cases in which this sign has been elicited, re-examination at a later date has shown a return to the norm in reflex response, thus differentiating it from the Argyll-Robertson pupillary response.

In pathological intoxication a temporary complete areflexia, i.e. a lack of response to both light and accommodation, has also been described.

The mental symptoms are usually succeeded by a complete exhaustion coupled with an obstinate anorexia. The term pathological intoxication has a definite forensic origin. As Schroeder[10] has stated, it is 'a concession to the opinion that all intoxications do not constitute mental disturbance in the sense of the responsibility concept of criminal law'.

The characteristic manifestations of the pathological reaction to alcohol are blind rages and confusion with usually complete amnesia for the condition. The condition is not limited to alcoholics but should it occur in the latter group, hallucinosis, not a usual symptom, may complicate the picture.

Occasionally grandiose and persecutory delusions appear and the behaviour of the individual seems fantastic and unreal to the observer.

As Jellinek[11] has observed, 'in the state of rage, anxiety and paranoia which characterizes the pathological reaction it is not surprising that crimes of violence are frequently attempted. Binswanger found that of 174 patients with this condition 15% had been charged with offences or crimes such as threats, manslaughter, attempted murder, arson, burglary and sex offences. In these cases we have a true nexus between alcohol and crime, although there may be no criminal predisposition'.

3. Permanent Pathological Intolerance to Alcohol

There is a small group of patients seen mainly in institutions among whom are those who have suffered severe head injuries, epileptics and those having a history of other organic psychosis. It appears that because of some as yet undefined organic cerebral disruption, symptoms remain latent until the patient's precarious hold on so-called sanity has been undermined by the action of some toxin. On occasions these patients have degenerated to such an extent as to be admitted to Mental Hospitals and here their response to incidental toxic illnesses is well known. One has seen a relatively docile and co-operative epileptic become quite maniacal and frankly psychotic for short periods when suffering from some pyrexial illness. The same phenomenon has been seen when members of this group take small quantities of alcohol. We have seen patients become wildly excitable and aggressive after consumption of only two to three tots of brandy. One particular patient, who is of low intelligence and has a

history of emotional instability, has exactly this response after ingestion of moderate amounts of alcohol. He has frequently been arrested for assault and causing a disturbance after taking small quantities of alcohol. Whereas ordinarily he is quiet and docile, although upset and weepy, in any situation of stress he becomes aggressive and abusive and completely loses control a short while after taking his first drink.

Although numerically small, this group of patients presents an extremely awkward problem and after taking amounts of alcohol normally accepted as compatible with our social mores and customs, they perform senseless and terrible acts of destruction. There is no doubt about their being psychotic at the time of the commission of the act and, therefore, not responsible even in terms of the M'Naghten Rules; but as soon as the effects of the alcohol wear off, they appear normal, are contrite and express regret for their behaviour. It is merely a case of latent psychotic manifestations being uncovered by temporarily placing the inhibiting mechanism in abeyance.

There are thus four clear-cut conditions which may be quoted as a defence where alcohol has been a possible contributory factor in charges of severe crime.

There is no doubt that, from a medical viewpoint, people suffering from these conditions and who commit crimes, cannot be considered to be sufficiently in control of their faculties to be responsible for their actions. It is somewhat superfluous to point out to the psychiatrist that the function of the law is to protect society as well as the individual, but often sight is lost of the fact that the same considerations should apply to patients certifiable under the Mental Disorders Act, No. 38 of 1916, who commit crimes. Here too, the function of the law in protecting society, is equally important. But in the latter instance, because of the accepted lack of responsibility on the part of the accused, steps are taken to ensure that medical treatment is available to the individual. In our present stage of development, although the effects of alcohol consumption are often cited, and accepted, as a mitigating factor in some types of crime, and the sentence imposed is as a consequence less severe, the accused, nevertheless, is denied treatment designed to give him insight and understanding into the causal relationship between his drinking and his anti-social behaviour. It is a completely paradoxical situation to place a man who had committed a crime only while temporarily in an abnormal state of mind, in an institution designed to deter him from indulging in criminal activities. The person who commits an offence only when his senses are anaesthetized by alcohol, cannot possibly gain from incarceration with hardened criminals. It is more than possible that the prison may be used as a training college and that the alcoholic will be influenced by the anti-social attitudes of his criminal neighbours, and consequently join the brotherhood. The curative attack should obviously be levelled at educating him to the stage where he

is able to live without recourse to a substance which results in so great a loss of control on his part that he indulges in crime. The need for specialized places of detention for the alcoholic criminal is certainly far greater from a numerical viewpoint than for an institution treating the criminally insane.

A proportion of alcoholic criminals, among whom are the psychopathic personality group, would not respond to any form of therapy or handling. In this group the law's responsibility to society can be the only consideration, and permanent institutional care is indicated. But there is a number of alcoholic criminals who could, with adequate treatment, be returned to society as useful citizens as are many Governor-General's decision patients.

The only solution here is the establishment of specialized places of detention where medical and social therapy is practised. Following the expiry of a sentence and when it is felt that the person has gained sufficient insight to allow him to adjust, a strict probationary system should follow. Drinking on the part of a probationer, even in the absence of criminal activity, should result in his return to the institution, as it is his abnormal response to alcohol which results in his anti-social actions. There are, of course, tremendous difficulties, both legal and material, in the development of such a system, but these are not insurmountable and a tremendous step forward would be taken in the treatment of a condition which has assumed the proportions of a major public health problem.

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Alcohol and Crime*

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I can add little to what Dr. Frame has already said about criminal responsibility in respect of crime committed. I would, however, wish to underline his contention. Glaister, in his classical volume *Medical Jurisprudence and Toxicology,* states:

'The abuse of alcohol by persons may, under certain circumstances, bring them within the category of insanity and irresponsibility. Although chronic alcoholism is one of the more indirect causes of insanity, nevertheless the direct effects of alcohol frequently induce insanity of a temporary nature, for example, delirium tremens. The common law rule is that mere drunkenness cannot be treated as an excuse for crime, but a state of mental unsoundness can be so pleaded and, if established by proof, would be held to be so. The position therefore resolves itself into the question whether or not an accused person, who has committed a crime while under the influence of alcohol, was sane or insane.'

The M'Naghten Rules I understand to state that to establish a defence on the grounds of insanity, it must be clearly proved that at the time of committing the act, the accused was labouring under such a defect of reason from disease of the mind that he did not know the nature and quality of his act; or, if he did, that he was not aware that he was doing wrong. From these rules it is clearly seen that there can be no convicition of crime in the absence of a criminal mind or *mens rea.*

I am further informed that in South Africa, although the law is Roman Dutch, precedents in the English courts are followed closely in criminal cases. If this is so, I presume that in South African courts also 'mere drunkenness cannot be pleaded as an excuse for crime'. If this is the proposition of the law, one can only agree with Mr. Bumble that 'if the Law supposes that, the Law is a ass—a idiot'.

The history of alcohol is coeval with the history of the origin of the human race. It would appear that every civilization, however primitive, learned first to distil alcohol, and then to worship the gods that the celestial liquors conjured up. In our own civilization, unfortunately, we have not

* A paper contributed to the symposium on *Alcohol and Crime* and read at a meeting of the South African Medico-Legal Society, Johannesburg.

accepted unquestioned the divine gift, but have attempted to analyse its effect upon the human organism.

Without going into any great biochemical details, it is known that the metabolism of the brain cells is dependent on 2 principal reactions, both of which involve glucose: (1) oxidation; (2) glycolysis—both aerobic and anaerobic. If anyone here does not understand what metabolism involves, the Oxford Dictionary states:

> '*Metabolism*—the process in an organism or a single cell by which nutritive material is built up into living matter, or by which protoplasm is broken down into simpler substances to perform special functions.'

Glycolysis is the process whereby sugar is decomposed and made available in its elements for the utilization of the cell. Both these processes involve the use of catalysts, a term first coined by Berzelius, and describing the effect produced in facilitating a chemical reaction by the presence of a substance which itself undergoes no permanent change. Alcohol is said to interfere mainly with the oxidation processes of the brain cells by inhibiting the action of the catalyst. It is said also to have a differential action affecting the cortical, or higher level, cells of the brain first. That this is not always so, however, can be deduced from the fact that certain individuals, mainly those unused to alcohol, often experience double vision and unsteadiness of gait while maintaining virtually intact intellectual integrity.

The purpose of this digression is to emphasize that alcohol acts most unfortunately not as a stimulant, but from the moment of its ingestion, as a depressant drug. Its first action is to interfere with the normal activities of those brain cells concerned with the higher functions of the brain. These functions concern primarily judgment, assessment of the appropriate action performed in any given set of circumstances, the forseeing of the result of any action initiated, and the evaluation of the effects resulting if a sudden impulse to act in a given direction were carried out. In fact, the highest and probably the most recently evolved characteristics of the brain are concerned with inhibition and censorship. Where alcohol is acting in any great concentration, it is just these functions that are knocked out.

In certain circumstances behaviour can be governed by primitive emotion alone. An individual under the influence of alcohol may receive a stimulus really insulting to him, or only apparently so, and react to this with undue violence, even to the extent of committing homicide. His actions in these circumstances are largely reflex, and the act performed is probably the result of a stimulus travelling from either the receptors of vision or hearing directly across the lower brain pathways (possibly in the hypothalamus) to the parts of the brain which initiate muscular movement, and the resultant act will be appropriate to the emotional pattern aroused, although the emotion experienced may never rise to the level of full consciousness. I would again emphasize that the whole process is virtually reflex and that because

of the differential action of alcohol on the higher and probably later evolved cells of the brain, the resultant pattern of behaviour may never rise to full consciousness. In such circumstances the individual will invariably have a complete absence of recall, or amnesia, for the acts committed. One could state that his actions are automatic. I feel that under such conditions 'mere drunkenness can be treated as an excuse for crime', for it is obvious that the act is not debated in the full level of consciousness and therefore at the time of committing the act, the person was labouring under such a defect of reason from disease of the mind, that he did not know the nature and quality of his act; or, if he did, he was not aware that he was doing wrong.

The concept of irresistible impulse must also be considered in this context. For if the act committed is the result of a reflex not involving consciousness, then the usual mechanism of censorship is in abeyance and the question of resistance does not arise. I feel that a plea of temporary insanity could be advanced in cases of homicide in these circumstances, where normally the accused would have no motive for procuring the death of the individual concerned. Considerable difficulty must, of course, arise in cases where the accused is acquainted with, and harbours animus against the person he kills, but yet could not have been expected to have anticipated a meeting with his victim at the time of the crime. If a person intentionally becomes drunk to commit a crime, then, of course, there is no defence.

Further difficulty arises on occasions in those subjects, the victims of epilepsy arising from one or other temporal lobe. Nielsen describes the case of an American officer who 'stole' a car from his camp. He was challenged at the gate, and immediately shot the challenger. When approached by a traffic officer for speeding, he immediately shot him. Finally cornered, he shot 2 more persons and then surrendered. There was no motivation for any of these acts. Apparently his electroencephalogram was abnormal, 'spike formations being found in one temporal lobe'. When informed of what he had done, the officer committed suicide. The story of this case would indicate an epileptic attack, characterized not by the usual convulsion, but by automatic and apparently purposeful behaviour. Such persons are amongst the most dangerous at large, because if their automatic behaviour is interfered with, they are apt to pass into a state of furor and commit the most atrocious acts.

I mention this condition particularly because, in all forms of epilepsy, attacks are apt to be precipitated by alcoholic excess; and where this type of epilepsy coincides with temporary drunkenness, the most tragic occurrences may eventuate. *Mania a potu,* which is defined as a state of pathological intoxication, consisting in extreme excitement, sometimes with homicidal attacks, and resulting from the ingestion of comparatively small amounts of alcohol in a susceptible individual, can probably often be explained on the basis of a temporal lobe epilepsy.

Some members of this Society may perhaps remember the case of *Rex* v.

Roach. This man had, for some considerable time, been on bad terms with his divorced wife. On one afternoon he took his children out and also had a few beers. On returning to his ex-wife's flat, he had a further beer and a half, and then became involved in an argument with her. This, he claimed, is the last he remembered. He then beat her to death with the base of a bird cage, using such extreme and prolonged violence that when the unfortunate woman was eventually seen in the Casualty Department of the General Hospital, the examining doctor's hand sank right into her head, which was, in fact, completely pulped. His subsequent behaviour and bearing, particularly when examined by Dr. Friedman, was so unusual that a psychiatric opinion was called for. In this man's previous history there had been 3 episodes of extreme violence, which appeared to have been provoked by quite inadequate causes.

I performed carotid angiography on this man—i.e. an injection of a dye to show up the arteries of the brain. During the procedure he had a typical epileptic fit, which arose from stimulation of the right side of the brain. X-rays showed an extreme degree of spasm of the trunk of the middle cerebral artery, just before it divided into its main cortical branches. This no doubt accounted for the fit on the table. The dye used is an irritating substance and both the fit and the arterial spasm might have been held to be of no significance, although I have neither before nor since produced a fit in some 400 similar procedures. However, 2 days later, under sedation, an electroencephalogram showed 'spike formations confined to the right temporal lobe.' It has been stated, again particularly by Nielsen, that such abnormalities are frequently missed, usually require sedation to bring them out, and have to be extremely carefully searched for. They are, however, of the utmost significance in cases where behaviour amounting to furor has occurred. I have no doubt in this case myself that the murder was committed in an epileptic furor, and that the 3 previous episodes of inappropriate violent behaviour were also explicable on this basis.

This man, during his lifetime, has had 4 episodes of extremely violent behaviour, quite inappropriate to the strength of the stimulus which precipitated any of them. The last resulted in the commission of a murder, accompanied by a degree of violence seldom seen, even in the most uncivilized and most unrestrained communities. It is interesting to note in his history that he was frequently subjected to incidents of provocation which would, in normal circumstances, induce the average male to resort to fisticuffs. Yet on several occasions he retired from the argument in the most pacific fashion whereas on 4 other occasions he apparently resorted to quite inappropriate violent measures. How can one explain his behaviour on the 4 occasions in question, except by an abnormal cerebral episode, almost certainly a temporal lobe attack? I feel that there is a strong probability that the final attack was precipitated by a not very excessive alcohol intake, and it is to be noted that the 3 previous violent

episodes all occurred within the precincts of the bars of hotels or, as they would be designated in Britain, public houses.

I do not propose to discuss the more chronic alcoholic conditions with which Dr. Frame has already dealt. I would, however, point out that to my mind there is no doubt at all that epilepsy can be produced by excessive and prolonged intake of alcohol. I have found the brandy of this country frequently the wine of choice where this condition has occurred. This may merely be that it is more readily available than other liquor. I have not as yet been able to inculpate whisky in these cases. Radiology, by means of air encephalogram, frequently shows in these people a degree of atrophy of brain and the total protein of the cerebrospinal fluid is almost invariably increased. They have, in fact, an alcoholic encephalopathy. Frequently such patients are angrily unreasonable, abnormally jealous and suspicious and not infrequently endowed with a pronounced mendacity and cunning. One can well conceive of such people, labouring under delusions of suspicion, committing violent crimes which, by reason of their cunning, they may temporarily succeed in concealing, thus giving the impression of complete sanity. Yet such patients would probably be labouring under a delusion completely divorced from reality and so strong as to drive them to acts for which they could not, in all fairness, he held responsible.

Korsakow's syndrome is a condition commoner in females, usually characterized by affection of the peripheral nerves and by a memory defect with disorientation for time and, to a lesser extent, for place and person. These patients have a remarkable ability to confabulate. They may fill in the lacunae in their recollections with the most convincing detail. The unwary may accept their evidence at its face value, and completely; whereas it is the result of over-developed mendacity.

Delirium tremens is a well-known condition already referred to by Dr. Frame. It is a toxic confusional insanity and a patient suffering from the condition cannot in any circumstances be held responsible, either medically or legally, for his actions.

I have dealt at length with those aspects of alcohol which can, at times, be held responsible for crime. It is fashionable nowadays to decry the benefits that may arise from the intelligent use of alcoholic beverages. The temperance influences are apt to gather statistics of crimes committed, broken marriages, business and professional failures, and the like. From the accumulated data they draw the inference that alcohol in some form or other is responsible for most of the ills of the present age. It seems to me that it is forgotten that only a very small minority of the adult population is teetotal. Where unfortunate or pitiable episodes are retailed and tabulated with relish, alcohol is by the law of averages bound to be in evidence. Today it is difficult to determine whether the ills of mankind are attributable to the abuse of alcohol, as canvassed by the temparance authorities, or to the deviation of the sexual instinct, as asserted by the

psychoanalysts. In spite of both contentions, however, I have little doubt that mankind will continue intelligently to use, and abuse, alcohol, and will not easily be led into a psychiatrically, pre-ordained, procreative pattern. In instances where alcohol is blamed for the catastrophe one often wonders whether the same breakdown would not have occurred without it. Intolerance of alcohol marks numerous constitutional weaklings and those who fall victim may be handicapped from the outset; nor can we foretell what clinical guise the disorder accompanying alcoholic excess will assume in any particular case.

The typical village pub, to my way of thinking, is almost certainly a strong factor in the prevention of crime in the rural communities of England. It forms a club where the average man can take his wife for a pleasant evening (even although it occasionally leads to mild inebriety) and there indulge his liking for darts or dominoes. A man who is partial to his pint of mild or 'mother-in-law' which, of course, is a mixture of old and bitter, is not likely to attack the same old lady with a hatchet. It was one of the great mistakes of the British Executive that it ever allowed the introduction of licensed grocers' shops. I can only agree with G. K. Chesterton that:

'God made the wicked grocer
As a mystery and a sign,
That men should shun the awful shops,
And go to inns to dine.
Where the bacon's on the rafter,
And the wine is in the wood,
And God, who made good laughter,
Has seen that they are good.'

The English pub is an institution that might well be more widespread. We must always remember that the ranks of the not unduly temperate have had their outstanding men. The late F. E. Smith, Earl of Birkenhead, was one of the greatest of legal luminaries. The great Pitt was said to be fond of his bottle of port. 'Noah drank of the wine and was drunken'. On the other hand, the late Adolph Hitler was a teetotaler.

'But Noah, he sinned, and we have sinned,
On tipsy feet we trod,
Till a great, big, black teetotaller
Was sent to us for a rod.
And you can't get wine at a P.S.A.
Or Chapel, or Eisteddfod,
For the curse of water has come again,
Because of the wrath of God.
And water is on the Bishop's board,
And the higher thinker's shrine.
But I don't care where the water goes,
If it doesn't get into the wine.'

Discussion

Mr. C. J. M. Nathan *: I should like to say a few words from the legal point of view on two aspects of the papers we have heard this evening. These are, firstly, the quantum of proof in prosecutions for driving under the influence of intoxicating liquor and, secondly, the burden of proof in cases in which intoxication is an issue.

Dealing with the first of these, I think I should point out that the Court's attitude in dealing with the quantum of proof of intoxication is, if I may say so, that of the ordinary layman, untrammelled by what we lawyers feel are often the niceties of medical jargon. Before reading you two extracts from the leading judgments on the point, however, I think it may be useful to quote for the benefit of the legal members of our Society, the very homely classification of intoxication quoted in Russell Brain's *Diseases of the Nervous System,* 2nd ed., in which he cites Bogen's correlation of the blood content with the condition of the drinker. This, as is pointed out, is only an approximate guide, but it is stated as follows:

'Less than 1 mg. per c.c. of blood—dry and decent.
1–2 mg. per c.c. of blood—delighted and devilish.
2–3 mg. per c.c. of blood—delinquent and disgusting.
3–4 mg. per c.c. of blood—dizzy and delirious.
4–5 mg. per c.c. of blood—dazed and dejected.
Over 5 mg. per c.c. of blood—dead drunk.'

Turning to the authorities, this is what *Maritz, J.* said in R. *v.* Donian, 1935 T.P.D. 5:

'It is not sufficient for the Crown to show that the appellant's breath smelled of liquor and (1) that he came down Osborne Road in a zigzagging course and (2) that he collided with a stationary car in an attempt to park his car in front of it, because (1) may have been due to the flat tyre and (2) may have been an error of judgment on his part.

'Nor do I think that because a man's breath smells of liquor he is "under the influence of intoxicating liquor" within the meaning of the section. To hold that these facts are sufficient to establish a contravention of the section, in spite of the explanation of the zigzagging and the collision, would impose a responsibility on motorists who are not total abstainers which could never have been contemplated. Although it is not necessary for the Crown to show that the driver of the motor vehicle is drunk and incapable, I think the Crown must prove something more than that the driver has had a few drinks, or that his breath smells of liquor. In my opinion the phrase "while under the influence of intoxicating liquor" in its context, means that the consumption of the intoxicating liquor must have impaired the driving efficiency of the motorist, for example, by dulling his vision, or blunting

* An Introduction to the Discussion of the papers on *Alcohol and Crime,* delivered at a Meeting of the South African Medico-Legal Society, Johannesburg.

his judgment, or making his muscular reactions to communications from his brain sluggish.'

This statement of the law was approved by the Appellate Division in R. *v.* Spicer, 1945 A.D. 433, in which Greenberg, J.A. laid down that in a prosecution for driving a motor vehicle under the influence of intoxicating liquor, it is sufficient to show that the skill and judgment normally required in the manipulation of a motor car is diminished or impaired as a direct result of the consumption of alcohol. His Lordship went on to say that the judgment of a driver is impaired not only when his vision is dulled or his judgment blunted or his muscular reactions to communications from his brain made sluggish, but also when the consumption of 'intoxicating liquor has induced an exuberant or over optimistic frame of mind which causes him to take risks (e.g. to drive at an excessive speed or to assume that others will give him the right of way) which he would not have taken but for the liquor he has consumed.' (at p. 436).

In regard to the second matter with which I want to deal, the onus or burden of proof in criminal cases involving questions of intoxication, two classes of case must be distinguished. In the first class where it is necessary to prove that a crime was committed with some particular intent, the onus is on the Crown to establish that the accused had that intent. For example, in murder, which is the unlawful killing of a human being with the intent to kill, or in theft which is the unlawful taking of another person's property with the intent to deprive him of his ownership therein, it is necessary for the Crown to establish that the accused had the particular intent in question. On the other hand, in a prosecution for culpable homicide, which is unlawful killing without the intent to kill or in, for example, rape, in which no specific intent is necessary, the onus would be on the accused to show that he was under the influence of intoxicating liquor at the time he committed the act, and even then this will not ordinarily relieve him of all criminal liability, but will only serve as a mitigating factor.

On this point I should like to quote from the judgment of *Schreiner, J.A.* in R. *v.* Taylor, 1949 (4) S.A.L.R. 702 at p. 712, A.D. His Lordship said:

'As the present case is one of murder, proof of the intention to kill . . . is part of the Crown's case. I agree therefore with the view indicated in *Innes-Grant's* case . . . that the *onus* of establishing that the applicant was not, by reason of the amount of liquor that he had consumed, incapable of forming the intention to kill rested upon the Crown. This does not, of course, mean that in every murder case where it is shown that the accused was at the time of the offence to some extent affected by or under the influence of liquor, the verdict should be one of culpable homicide and not of murder on the ground that wherever alcohol has affected the accused's mind in any degree it is not possible to assert with reasonable certainty that he was capable of forming the requisite intention. That is far from being the true position. In a very large proportion of cases where a person would ordinarily be described as under the influence of liquor or even drunk, it may nevertheless

be manifest from his behaviour that he is quite capable of realizing what he is doing and of forming the intention to act and to achieve the consequences of his acts. I have used the language of capacity as that is the language that is generally used in this connection (see for instance D.P.P. *v.* Beard, 1920 A.C. 479).

'The ultimate inquiry is whether the Crown has in all the circumstances proved beyond reasonable doubt that the accused had the intent in question at the time when he did the act; but the presumption, or reasonable assumption, that a man intends the natural consequences of his acts must lead, ordinarily if not invariably, to the conclusion that an accused person who was capable of forming the relevant special intent did in fact form it before or when he did the act.'

Innes-Grant's case (1949 (1) S.A.L.R. 753 (A.D.)) was a culpable homicide case. At page 765 *Centlivres, J.A.*, said:

'In the present case the charge on the first count is that the appellant unlawfully caused the death of the deceased. No question of a specific intent therefore arises, and it is clear on all the authorities that, if the appellant became intoxicated of his own free will, such intoxication provides no defence (there being in this case no question of a disease of the mind such as delirium tremens), but it may in certain circumstances be a ground for mitigation of sentence . . . The authorities draw a distinction between voluntary and involuntary intoxication. There is, for instance, the well-known passage in Hale's *Pleas of the Crown* (p. 31), where he says that insanity is a defence to a criminal charge, and adds: "If a person by the unskilfulness of his physician or by the contrivance of his enemies eat or drink a thing as causeth such a temporary or permanent phrenzy as *aconitum* or *nux vomica*, this puts him into the same condition, in reference to crimes, as any other phrenzy and equally excuseth him." The real question in this case, however, is whether the appellant was in such a state of phrenzy, as Hale puts it, as to excuse him for the killing of the deceased or, as *Wessels, J.*, indicates in R. *v.* Bourke, 1916 T.P.D. (at p. 307), where his intoxication, due either to luminal or alcohol or both, is so severe as to be an excuse. Was he, in other words, at the time his motor car collided with the deceased in such a condition as not to be legally responsible for negligence? Where a person becomes intoxicated through no fault of his own, it seems to be obvious that the question of guilt must depend on the degree of his intoxication.'

His Lordship then considered the facts and held that the Crown had proved beyond a reasonable doubt that the appellant was responsible in law for his behaviour when he collided with the deceased. His Lordship continued:

'As regards the second count there is an additional reason for holding that the appellant is guilty. He was there charged with contravening Section 48 (1) (b) of the Cape Ordinance, 15 of 1938, in that he drove a motor vehicle upon a public road while under the influence of intoxicating liquor or narcotic drugs. *Prima facie* the Ordinance was satisfied when the case was brought within its terms by the appellant's own averment that he was under the influence of luminal, a narcotic drug, and it then lay on him to prove that the violation of the Ordinance had been committed by him innocently . . . To prove his innocence the appellant would have to prove affirmatively on a balance of probabilities that luminal had been administered to him without his knowledge and that, if it had not been so administered, he would not have been in the condition he was in at the time of the collision. He has failed to prove this.'

Dr. I. Freed: Dr. Frame has enumerated those psychiatric disorders which can be attributed to the ingestion of alcohol. It is important to appreciate the fact, however, that liver disease in itself, no matter what its cause or its extent, may produce a psychiatric and neurological disorder which may be indistinguishable from those described by Dr. Frame. Furthermore, as the pathogenesis of this disorder in liver diseases has recently been elucidated, its medico-legal implications become all the more pertinent.

In a group of 18 patients with liver diseases recently studied by Dr. Sheila Sherlock and her co-workers[1] at the Postgraduate Medical School (London), it was observed that any or all of the following abnormalities might occur: mental confusion, apathy, emotional lability, grimacing, blinking, vacant facial expression, increased salivation, slow, slurred speech, restriction of speech to the repetition of a few irrational phrases, clouded comprehension, socially bizarre behaviour exemplified by lack of restraint, and nocturnal ramblings.

These episodes commonly began in the late evening, were of variable duration, and might terminate at any stage, the patients having no recollection of their actions.

Of special importance was the observation that exacerbations of these disorders could be made to follow a diet whose protein content was more than 70 gm. per day, or when methionine or ammonium chloride was added. Similarly, these symptoms could be made to abate when the protein content of the diet was reduced to 20 gm. per day, or when methionine or ammonium chloride was withheld.

Biochemically, it was found that in all the patients with neurological complications, the fasting level of ammonia in the peripheral blood was above the upper limit of normal (1 μg. NH_4N per ml.) and above mean levels found in patients with liver disease uncomplicated by nervous disorder. As portal venous blood normally contains a high level of ammonia, presumably derived from the nitrogenous contents of the intestine, which is metabolised as the blood passes through the liver, elevation of the systemic blood ammonium level could arise from failure of the liver to metabolise ammonia reaching it from the portal blood or by diversion of portal venous blood into collateral channels. Thus, it was observed that in patients with severe hepatocellular damage the ammonium levels in the hepatic veins exceeded those in the peripheral veins, indicating that ammonium carried in the portal vein was passing through a damaged liver. Conversely, in patients with extensive portal-systemic collaterals, the ammonium levels in peripheral veins usually exceeded those in the hepatic veins, suggesting that ammonium from the portal veins was entering the systemic circulation without passing through the liver. In seven of this group of cases, the cerebrospinal fluid also showed elevation of the ammonium levels without any other biochemical or serological abnormality.

The administration of nitrogenous substances other than methionine and ammonium chloride with consequent mental disturbances was reported in 1952 by Phillips and his co-workers[2] at the Boston City Hospital. They described such disturbances following the use of ammonium potassium cation exchange resins, di-ammonium citrate, urea and dietary proteins, whilst they refer to a patient of Gaustad in whom transient coma developed after consuming 250 gm. of dried milk a day.

The interesting fact emerges that persons suffering from various types of liver disease may, without the use of alcohol at all, commit anti-social acts directly as a result of eating a high protein diet, and it is not unreasonable to conjecture that this fact may, in a legal sense, be submitted as a mitigating circumstance.

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The Results of a Blood Alcohol Testing Program in a Rural State*

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The extent of the menace of the drinking driver is not fully appreciated by the public or even by most of the medical profession. Surveys [1-6] in the United States have repeatedly shown that alcohol was present to a significant degree in the blood of about 45% of drivers killed in automobile accidents, and equally present in only a slightly smaller number of slaughtered pedestrians. If these figures are representative of the country as a whole where 38,000 persons were killed on the highways in 1952, then in that year alcohol was a contributing factor in the deaths of at least 17,000 persons from motor vehicle accidents alone. In addition to these fatalities there were 1,350,000 non-fatal traffic accidents. Alcohol may well be a factor in the production of highway accidents resulting in the injuries received by more than half a million people in 1952 in the United States alone. While much of the data concerning drunken driving has been compiled from urban figures, there is no reason to believe that the same problem does not exist in rural communities.

Procedure in Vermont

In Vermont, a rural state of 377,000 population and an area of 4,500 square miles, there are 50 State Troopers in the field plus a few sheriffs and municipal policemen. This number of officers is obviously inadequate to patrol the more than 30,000 miles of roads during each 24-hour day. While drivers are apprehended for alleged drunken driving at the rate of about 2 a day, it is obvious that many are not caught. Approximately 40% of these apprehensions are made following accidents when it appears that the driver is under the influence of alcohol. The remaining arrests

* Condensed from a paper presented at the Sixth Annual Meeting of the American Academy of Forensic Sciences at Chicago, Illinois, on 27 February 1954.

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are made when an officer observes a driver weaving down the road or exhibiting behavior consistent with driving while intoxicated.

Shortly after arrest the defendant is arraigned in municipal court. If he pleads guilty, he is usually fined $100 and costs. His driver's license is also revoked for one or six years following a conviction for first or second offense, respectively, or for life if a third conviction.

If the defendant pleads not guilty, he is usually released on bail of $300 to await trial. Before trial many of the defendants change their pleas when the result of the blood alcohol determinations are available. At the trial, the physician who examined the defendant testifies for the State but seldom interprets the level of blood alcohol. The chemist testifies only to the continuity of evidence and the method and results of his analysis. The chemist's findings are correlated with other medical and non-medical testimony and interpreted either by the State Pathologist or another physician with special qualifications in this field.

Methods of Selection of Data

The data concerning details of the arrests and convictions presented in this paper were drawn from the files of the Vermont State Police.* These files are the repository of information concerning arrests and convictions made by all law enforcement agencies and courts. Names of about 500 violators were drawn at random from alphabetical card files. It was only known that each had been arrested for driving while under the influence of intoxicating beverages within a 3-year period from July 1949 through July 1952. The charts were later compiled. It was found that in a few cases there was no record of the disposition of the case. The latter were excluded leaving a total of 473 cases with reasonably complete information. Since certain of these did not include all the desired information, some of the accompanying charts are based on fewer than 473 cases. The results of the analyses for blood alcohol for each violator submitting to a blood test were obtained from the records of the Vermont Department of Health.

Results

Tables 1 and 2 reveal that in 1952 there was one arrest for driving while intoxicated for each 233 licensed Vermont drivers or 1.65 persons were arrested for every 1,000 men, women and children of our population. As far as can be determined from data compiled by the National Safety Council[7] Vermont arrests more drivers per population than any other reporting state except Arizona. It is likely, however, that the reports from some of the states are incomplete and do not present a true figure of total arrests.

* This phase of the study was undertaken by Mr. Dewees H. Brown while supported by a Predoctoral Fellowship of the National Foundation for Infantile Paralysis.

Table 1: Number of Arrests for DWI* in Vermont

Number of licensed drivers in Vermont	147,215
Annual arrests for DWI	634
Blood test obtained	68·2%
1 arrest for every 233 Vermont drivers per year.	

*Driving while under the influence of intoxicating beverages

Table 2: Number of Arrests for DWI by Selected States[7]

State	*Arrests*	*Arrests per 1000 Population*
Arizona	2,874	3·84
California	3,786	0·364
Delaware	176	0·553
Michigan	104	0·016
New Hampshire	121	0·227
New Mexico	931	1·367
Vermont	624	1·65

Fig. 1 reveals the results of analyses of blood alcohols in 473 cases. 150 of the arrested persons refused to submit to blood sampling. Of the

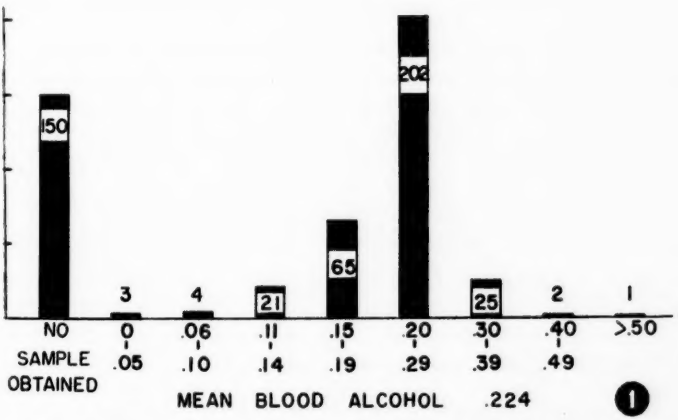

Fig. 1. Distribution of Blood Alcohol in 473 Arrests for DWI.

remaining 323, 87% contained in excess of 0.15% of alcohol by weight. Of the 28 drivers whose blood alcohol was less than 0.15%, most were unconscious or stuporous following an automotive accident and the blood was drawn on suspicion of the arresting officer. The fact that so many of the bloods were over 0.15% illustrates that officers are capable of deter-

mining clinically that a man is definitely under the influence of alcohol, and also that probably too few arrests are made in less obvious cases when the blood is perhaps between 0.10 and 0.15% but may be above 0.15%. The fact that the blood alcohol level can be predicted with moderate accuracy is illustrated further by the experience of one of the physicians in the State. This physician draws about 100 blood samples each year. For each sample that he submits to the State Laboratory he records his estimate of the blood alcohol. In only one instance has his estimate differed by more than 0.04% from the chemical analysis. In this particular case the suspect, while he had been drinking, had also suffered an unrecognized skull fracture with cerebral concussion. Our experienced policemen find that they are able to estimate the blood alcohol level with considerable accuracy whereas the less experienced officers may misjudge the blood alcohol widely.

As might be expected, Table 3 indicates that almost half of the arrests

Table 3: Distribution of Arrests for DWI—Time of Day

Total cases	183
Morning, 6.00 a.m.—12.00 Noon	2·2%
Afternoon, 12.00 Noon—5.00 p.m.	18·0%
Evening, 5.00 p.m.—10.00 p.m.	32·8%
Night, 10.00 p.m.—6.00 a.m.	47·0%

for driving while under the influence were made between the hours of 10.00 p.m. and 6.00 a.m. Nevertheless, a small but definite number was made in the morning and a suprisingly large number during the afternoon.

The mean blood alcohol of drivers was essentially the same during the four seasons of the year, as shown in Table 4. The number of cases,

Table 4: Distribution of Arrests for DWI—Season of Year

	Number of Cases	*Mean Blood Alcohol*
Spring	87	0·228
Summer	104	0·215
Fall	64	0·225
Winter	69	0·232
Total	324	0·224 *Average.*

however, showed a sharp increase during the summer which may reflect, in part at least, the tourist travel. It is interesting to note that the mean blood alcohol is well above the level arbitrarily set by the National Safety Council as 'under the influence of alcohol.'

In Table 5 are data supporting the fact that in all 3 groups after the

Table 5: Plea to Charge of DWI

Blood Alcohol	Number of Cases	Initial		Final		
		Per Cent. Guilty	Per Cent. not Guilty	Per Cent. Guilty	Per Cent. not Guilty	Per Cent. Guilty of a Lesser Charge
No sample obtained	150	66·7	33·3	77·3	14·7	8·0
0·14 or less	28	42·8	57·2	46·4	28·6	25·0
0·15 or more	295	76·9	23·1	85·4	10·1	4·4
Total	473	71·7	28·3	80·5	12·7	6·8

sobering-up period, more persons pleaded guilty rather than stand trial. While a larger percentage of those refusing a blood test eventually changed to a plea of guilty, the final number pleading guilty in this group was significantly lower than those whose blood alcohol was in excess of 0.15%. The larger percentage of defendants allowed to plead guilty to a lesser charge when their blood alcohol was below 0.15% was expected. This charge is usually careless and negligent driving.

Table 6 summarizes the final disposition of drunken driving cases.

Table 6: Final Disposition of DWI Cases

	Total Cases	Per Cent. Guilty	Per Cent. Guilty of a Lesser Charge	Per Cent. Not Guilty	Per Cent. Nol Prossed
No sample obtained	150	80·7	9·3	—	10·0
Alcohol < ·15	28	46·4	25·0	—	28·6
Alcohol > ·15	295	86·8	5·7	1·3	6·2
Total	473	82·7	8·0	0·8	8·5

Approximately 87% of all drivers possessing a blood alcohol in excess of 0.15% at the time of arrest were eventually found guilty. In this group, 1.3% or approximately 3 out of a total of 295 cases, were found not guilty by jury trial. Two of these, as will be shown later, were second or third offenders. The group who refused a blood sample contains a larger number who were either nol prossed or allowed to plead guilty to a lesser charge. The still larger percentage of those who were nol prossed or allowed to plead to a lesser charge among those whose blood alcohol was under 0.15% is self-explanatory but perhaps presents evidence that our laws for prosecution of these latter drivers should be strengthened.

The relation of the level of the blood alcohol to the number of accidents, as shown in Fig. 2, indicates that those with alcohol above 0.20% were involved in fewer accidents than drivers with a lower blood alcohol or

those who were not tested. One explanation is that drivers with a level above 0.20% were so grossly intoxicated that they weaved down the road and were more apparent to the police, while operators with a blood alcohol below 0.20% were not as readily detected until an accident or other violation brought them to the attention of the police.

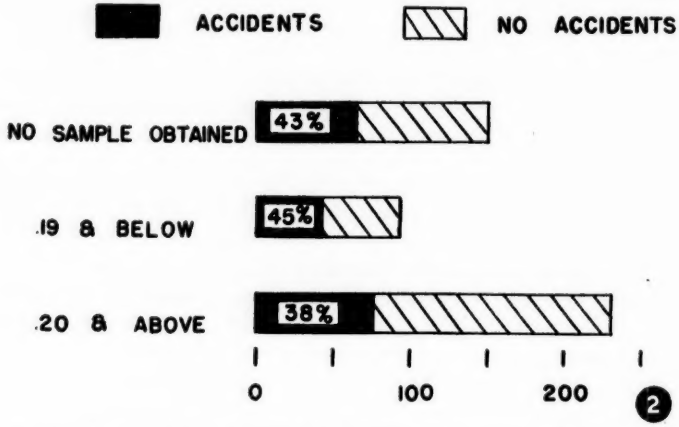

Fig. 2. Relation of Blood Alcohol to Number of Accidents. Based on 473 Cases.

Table 7 illustrates the relation of convictions to accidents. In our experience, the mere fact that a drunken driver happens to have an accident

Table 7: Relation of Convictions to Accidents

		Convictions			*No Convictions*		
	With Accidents	*Number of Cases*	*Per Cent. of Accidents*	*Per Cent. No Accidents*	*Number of Cases*	*Per Cent. of Accidents*	*Per Cent. No Accidents*
No sample obtained	43%	135	40·0	60·0	15	67·7	33·3
0.14 or less	45%	20	40·0	60·0	8	62·5	37·5
0.15 or more	38%	273	34·1	65·9	22	50·0	50·0
Average			36·2	63·8		57·8	42·2

does not, by itself, warrant the conclusion that he is more likely to be convicted. In fact, conviction is less likely. As to why this is true, we have no answer.

Table 8 shows the differences between the first and subsequent arrests for drunken driving. It demonstrates that repeated offenders have learned

Table 8: Initial Versus Subsequent Offenders

	Number of Cases	*Per Cent. with Blood Sample*	*Per Cent. with Accidents*	*Mean Blood Alcohol*
Initial	451	68·3	38·5	0·22
Subsequent	22	45·5	40·9	0·27

the lesson that a blood sample may so seriously incriminate them that they permitted far fewer samples to be drawn. Although there was no significant difference in accident rates between initial and subsequent offenders, the mean blood alcohol of the second and third time offenders was significantly higher, presumably indicating individuals more capable of adjusting to their higher degree of intoxication, and perhaps indicating that the subsequent offenders were chronic alcoholics more inclined to heavy drinking.

More striking than these differences, however, were the pleas and final dispositions of the initial and subsequent offenders. As Table 9 indicates,

Table 9: Initial *Versus* Subsequent Offenders

	Initial Plea		*Final Disposition*			
	Per Cent. Guilty	*Per Cent. not Guilty*	*Per Cent. Guilty*	*Per Cent. not Guilty*	*Per Cent. Guilty of a Lesser Charge*	*Per Cent. Nol Prossed*
Initial	71·7	28·3	82·7	0·8	8·3	8·5
Subsequent	45·5	54·5	68·2	9·1	18·2	4·5

only 72% of the first offenders pleaded guilty as opposed to only 45% of the second and third time offenders. Whereas 83% of the first offenders were eventually pronounced guilty, only 68% of the second and third time offenders were so found. Of this latter group, 18% were allowed to plead guilty to a minor offense but only 4.5% were nol prossed. Although many subsequent offenders were found guilty of a lesser charge, most of these were found guilty of careless and negligent driving and had their licenses suspended for 6 months.

The variation in the efficiency of prosecution among the counties of Vermont is shown in Table 10. Prosecutors in 9 counties containing

Table 10: Final Disposition of DWI Cases by Counties

Number of Counties	*Population*	*Number of Cases*	*Per Cent. Guilty*	*Per Cent. Acquitted*	*Per Cent. Guilty of a Lesser Charge*	*Per Cent. Nol Prossed*
9	182,086	159	94·5	0·6	1·9	3·1
5	195,661	156	71·8	1·3	12·2	14·7
Total	377,747	315	83·2	1·0	7·0	8·9

approximately half of the population convicted 95% of the defendants, while in the other 5 counties, 4 of which are the largest in the state, prosecutors secured convictions in only 72% of the cases.

Conclusions

The results of the blood alcohol testing program in Vermont have been presented. The magnitude of the problem of the drinking driver is emphasized by the fact that 1.65 arrests for DWI per year are made for every 1,000 men, women and children of the population.

That a blood testing program is effective in assisting the prosecutors in securing convictions is borne out by the fact that far fewer second and third time offenders will submit to testing.

This survey also demonstrates that while a vigorous blood testing program is helpful in convicting drunken drivers, and that excellent results are obtained by the majority of counties, several problems still exist.

More police are required for adequate surveillance of the drivers.

More arrests should be made in borderline cases.

Salaries of prosecuting attorneys should be increased to attract and hold men of high caliber.

Finally, some means must be found to overcome public apathy and the far too common reaction of the juryman, 'There but for the Grace of God, go I.'

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The Significance of Manganese in Human Tissues

III. Poisoning by Potassium Permanganate

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The toxicology of compounds of manganese presents a somewhat complex picture due to the different types of compounds formed by manganese. Cases of poisoning by such compounds may be roughly divided into the 2 classes of chronic and acute poisoning. The former are mainly due to exposure to dust from manganese compounds with consequent inhalation. Such a condition may arise from grinding operations, especially those involving oxides of manganese. As a consequence, manganese has been added, in most countries, to the list of industrial hazards. Manganese dioxide is chiefly responsible for the toxic effects in such cases and these are particularly evident in the mining of manganese ores. Normally the salts of manganese are not highly toxic, although such salts in large amounts may cause acute irritation of the stomach and intestines.[2] Manganese, like iron, is not readily absorbed through the intestinal tract. Acute poisoning by manganese compounds is usually due to the ingestion of sodium or potassium permanganate. A solution of permanganate in contact with organic matter, such as albumin, will lose its oxygen in the destruction of the organic matter and in the process become converted into manganese dioxide. Permanganate is thus poisonous to protoplasm. After oxidation, permanganate loses its property of oxidation and the effect is therefore limited to surfaces such as the mucous membrane and permanganate fails to penetrate tissues in its active form. Concentrated solutions of permanganate corrode the skin and also induce gastro-enteritis when ingested.

Apart from signs of irritation and corrosion, the most evident symptoms of manganese poisoning, particularly in cases of chronic poisoning, are those of a nervous or psychical nature. There is implusive laughing or crying, monotonous speech, cramp in the legs, muscular twitchings and increased tendon reflexes.[4] In cases of poisoning by permanganates, there may be staining of the mouth and alimentary tract, due essentially to the deposition of manganese dioxide in the tissues. The liver suffers the most damage in

cases of manganese poisoning[2] and post-mortem examination reveals cirrhosis of the liver with nephritis.[8]

Although cases of poisoning by permanganate are not common, such cases have been investigated in this laboratory. This compound has been responsible for death. Manganese is excreted mainly through the intestines and only traces are usually found in the urine.[1] Glaister[5] states that, in cases investigated by him, manganese was not found in the urine. Taylor[8] states that potassium permanganate and manganese dioxide have been used as direct emmenagogues but that there is no evidence of any action on the uterus.

There appears to be little information available concerning the amounts to be expected in the organs in cases of poisoning by potassium or sodium permanganate and, in view of statements made above, the quantities in such cases are likely to be small. In addition, the widespread distribution of manganese in nature will suggest that traces of manganese will normally be present in human tissues. Reiman and Minot,[7] for example, found that blood normally contained 0.05–0.2 parts per million of manganese while Monier-Williams[6] has summarized the work on these lines and states that the manganese content of human and animal tissues and organs ranges from 0.2 to 4.0 parts per million. In Part II of this series[3] the author has reported the amounts of manganese which can normally be expected in various tissues of human beings in this country.

As examples of the amounts of manganese found in the organs in cases of poisoning by permanganate, the results, given in Table I, are for cases which have been examined in this laboratory:

Table I

Case No.	*Race and Age*	*Organ*	*Total Mn.**	*P. p.m. Mn.†*
946/49	Native 3 years	Alimentary Tract	7·8	173
6431/49	Native 45 years	Liver	2·87	2·2
		Kidneys	0·36	1·8
		Stomach	0·15	0·8
		Colon	1·97	6·2
2292/51	Native 14 years	Liver	3·53	4·6
		Kidneys	0·45	3·0
		Stomach	0·23	1·5
		Intestines	0·30	2·0

* Total manganese in terms of mg.

† Manganese in terms of parts per million or mg. per kg.

For purpose of comparison the following data, as reported in Part II of this series, are given in Table II in terms of parts per million:

Table II

Origin	*Organ*	*Average*	*Range*
Native Child	Stomach	1·45	0·50—4·07
	Intestines	1·05	1·05—1·25
Native Adult	Liver	1·46	1·05—2·09
	Kidneys	0·75	0·57—1·00
	Stomach	0·70	0·22—1·27
	Intestines	0·81	0·39—2·02

On comparing the data given in the last column of Table I with those in Table II it will be evident that considerable support is given to the contention that manganese is not readily absorbed from the alimentary tract. The figures in Table I do not indicate any excessive accumulation of manganese in organs such as the liver and kidneys.

The first case, No. 949/49, was received from Umtata and is a case where positive evidence had been supplied that potassium permanganate had been ingested. The child was stated to have sucked some crystals of potassium permanganate on one day and to have died the following day. No further information was supplied and no post-mortem appearances were described. The upper alimentary tract with the stomach and a loop of the jejunum were submitted for examination. The mouth and gullet were stained brown due to the deposition of manganese dioxide in the surface tissues. In view of the high concentration of manganese found in the exhibit, there can be no doubt that the child died from the effects of permanganate poisoning.

The second case, No. 6431/49 from Randfontein, provides a good example of the contention that manganese is not readily absorbed from the alimentary tract. It will be noticed that the manganese content of the liver is not appreciably greater than the amount which has been found normally to be present, although the amount in the kidneys is higher than normal. The deceased was admitted to hospital on 4 October 1949 after having been treated by a Native 'witch doctor'. His condition appeared to be satisfactory until 6 October when he suddenly collapsed and died. The only indication that some poison may have been the cause of death was the statement that 'it was suspected that a corrosive poison was administered to the deceased by means of an enema'. The post-mortem report stated that there was 'necrosis of the large bowel from the rectum to the sigmoid flexure of the colon and congestion of the stomach mucosa and other abdominal organs'. The liver and kidneys were also stated to be congested. The immediate cause of death was given as 'pulmonary embolism'. The symptoms described were consistent with the administration of a corrosive poison. The high concentration of manganese in the colon and the relatively low concentration in the stomach would be in accord with the administration of potassium permanganate in the form of an enema. Although the concentration of manganese in the liver and kidneys is some-

what higher than normal, the increase in such is to indicate that absorption from the intestinal tract has been by no means excessive.

The third case, No. 2292/51 from Southport, Natal, is an example of a case where the deceased was known to have taken potassium permanganate by mouth. The youth became ill after having eaten some raw mussels during the morning, the symptoms developing during the afternoon. That evening he was given potassium permanganate to drink but no indication was given of the amount taken. The following morning he was still sick and was given a dose of Epsom salts. He died about 11 a.m. the same day. Death was stated to be due to 'acute enteritis'. The post-mortem report stated that 'the lower two-thirds of the small intestine were acutely and diffusely inflamed and contained blood-stained watery fluid'. All the other organs were described as 'normal'. The relatively high concentration of manganese in the liver and the kidneys indicates that there has been a greater absorption from the alimentary tract than in the previous case where administration had been in form of an enema.

Unfortunately in none of these cases was there any indication of the amount of permanganate ingested. However, it is very clearly important to know the normal manganese content of the organs if any conclusion is to be drawn from the chemical analyses. This is particularly true in the case of manganese administered in the form of potassium permanganate when the absorption from the alimentary tract is small. It would appear that the permanganate becomes reduced to the insoluble compound, manganese dioxide, which is deposited in the surface tissues.

The author would like to thank those members of the Staff of the Government Chemical Laboratories who supplied the data for this paper.

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REVIEWS OF BOOKS

Famous Criminal Cases

Famous Criminal Cases (1). By Rupert Furneaux. (Pp. 205. 12s. 6d.). London: Allan Wingate (Publishers) Limited, 1954.

Contents: 1. The Monster of Rillington Place. 2. Miles Giffard. 3. Craig and Bentley. 4. Love from a Stranger. 5. The Murder of the Blackpool Widow. 6. Mute by Visitation of God. 7. The Clapham Stabbing Case. 8. The Bath Race-Horse Switch. 9. The Towpath Murders. 10. A Motiveless. Murder 11. Chesney. 12. An Unsavoury Case.

This is a readable and informative account of crime in the Coronation and H-Bomb period which produced a 'bumper crop of criminals', including the undoubtedly puzzling murders in Rillington Place, associated with the names of Evans and Christie, and which may yet alter the law of capital punishment in England.

Mr. Furneaux claims (p. 27) that the Report of the Enquiry (appointed by the Home Secretary to allay public misgivings about the author of the multiple murders) appeared 'to publish only evidence which supported its findings, ignoring as the *Observer* has pointed out "all the arguments and facts which seem to point in the opposite direction" . . . there seems to be far more evidence now to indicate that Evans was innocent than there was in 1950 to prove that he was guilty'.

These disturbing reflections indicate the great sense of responsibility with which the author has approached the task of editing an extremely interesting series of crimes which range from murder to simple confidence tricks.

The analysis of the trial of Lord Montagu, Michael Pitt-Rivers and Peter Wildeblood for homosexual offences is done with a sympathetic appreciation of an issue from which obscuring prejudice has by no means been eliminated. Mr. Furneaux includes in his account of this case an instructive history of social attitudes towards homosexual offences.

The great variety of cases in this volume is presented competently and without undue emotionalism. The title indicates that this is the first of a series of books. Mr. Furneaux's initial contribution speaks well for those volumes that are to follow.

A New Journal on Alcoholism

International Journal on Alcohol and Alcoholism: Official Organ of the International Institute for Research on Problems of Alcohol (*Vol. 1, No. 1, April 1955, pp. 72*). Editors: E. M. Jellinek and H. Pullar Strecker. Published three times yearly by Blackwell Scientific Publications, Oxford, England. Single copies, 12s. 6d. Annual subscription, 30s.

It is always a considerable undertaking to launch a new journal, especially at the present time, when the conscientious reader is likely to be overwhelmed by the deluge of print which descends upon him. In the special field of alcohol and alcoholism, however, a publication devoted to fact rather than fancy is most welcome and is likely (and deserves) to enjoy a considerable support.

The extent to which alcoholism creates problems which reach out far beyond the victim himself is well illustrated by a recent survey of the Economic Research Council in the United Kingdom (based on police reports). This survey reveals that while drunkenness among adults in Britain is declining, among the young it has increased by 7.5% between 1953—1954. Alcoholism has been accompanied by more crimes of violence amongst teenagers and an increase in illegitimate children born of young girls. The rate of illegitimate births rose by 9% in unmarried girls under 21 years and by 23% in unmarried girls under 17. This serious situation is by no means peculiar to the British Isles, and the establishment of an international forum for the discussion of all the grave ramifications of alcohol and alcoholism is clearly most timely.

The policy of the new publication is stated succinctly in a brief editorial, which we quote in full:

'It is only within our own time that study of alcohol and its repercussions has become a science in its own right. This has, however, produced a mounting tide of publications: every year a million words on alcohol appear in medical journals alone. There is now need for a journal with express international

scope to sift and correlate; a journal devoted to facts and figures rather than hypotheses.

This is what the *International Journal on Alcohol and Alcoholism* sets out to do. It serves the needs of science as well as of medicine, dealing with every aspect of the subject. Its Editorial Board consists of scientists and clinicians in equal numbers.

The *Journal* is the official organ of the International Institute for Research on Problems of Alcohol; it appears in April, August and December. So as to reach colleagues everywhere, it makes use of five languages—English, French, German, Italian and Spanish—and opens its pages to workers of all nations.

Unlimited and all-embracing in its scope, the *Journal* publishes, in particular, comprehensive country-by-country surveys in which the specific problems, achievements, statistics, etc., of each are reviewed from every angle. The first issue (April 1955) contains such surveys on Canada and Austria.

In addition, lists of the latest world literature appear, and classified bibliographies not accessible elsewhere, such as a complete index of the current Antabuse literature.

Under *Current Periodicals* are listed the contents of every existing periodical on alcohol and alcoholism, including suitable lay publications. *Questions and Answers* invite readers to bring forward their own specific questions and problems (which will be discussed by experts in that particular field), and *Notes and News* will deal with present and forthcoming events.'

In addition to the surveys on Canada and Austria which form a considerable part of the first issue, Dr. W. Liddell Mulligan, Physician Superintendent, St. James Hospital, Portsmouth, contributes an interesting paper on *The Use of Intensive E.C.T. in the Treatment of Chronic Alcoholism.* The classified bibliography on Antabuse (Antabus, Disulfiram, T.E.D.) covers 251 articles and is a major contribution to the analytical presentation of the data on this important subject. It is to be followed in the next issue by a bibliography on substances other than Antabuse causing hypersensitivity, etc., to alcohol.

The section on *Notes and News* conveys much of international topical interest. To it we would add the important legislation recently introduced in Southern Rhodesia on the question of performing blood tests on arrested persons. In the Union of South Africa the Criminal Procedure Act (gazetted on 1 July) permits *any* blood test to be taken to ascertain whether the body of the arrested person bears 'any mark, characteristic, or distinguishing feature, or shows any condition or appearance' (Section 289). This evidence is admissible whenever it is relevant to an inquiry and shall not be rendered inadmissible by the fact that the information was ascertained otherwise than in terms of Section 289 or against the wish or will of the accused (Section 291).

The editorial touch, while always serious, is not always solemn. It was pleasant to come across the reference to Joseph Wechsberg's charming report on *Der Heuriger* which appeared in the *New Yorker* of 23 October 1954. *Der Heuriger* is 'a place where the Viennese gather to drink this year's wine'.

Industrial Medicine and Hygiene

Industrial Medicine and Hygiene, Volume II. Edited by E. R. A. Merewether, *C.B.E., O.St.J.*, M.D., F.R.C.P., D.I.H., F.R.S.Ed., Barrister-at-Law, H.M. Senior Medical Inspector of Factories, Ministry of Labour and National Service; Chief Medical Adviser, Ministry of Agriculture and Fisheries. (Pp. 433.) London and Durban: Butterworth and Co. (Publishers) Ltd., 1954.

* *Contents:* 1. Occupational Skin Diseases. 2. Occupational Ophthalmology. 3. Occupational Psychology. 4. Medical Aspects of Compressed Air Illness. 5. Compressed Air in Civil Engineering. 6. Compressed Air Illness in Diving. 7. Precautions for Men Working in Compressed Air. 8. Electrical Accidents. 9. Explosives. 10. Heating and Ventilation. 11. Lighting, Glare and Efficiency. 12. Intense Sound and Ultra-Sound. 13. Effects of Ionizing Radiations. 14. Protection Against Ionizing Radiations.

In the previous issue of this *Journal* (p. 124) we drew attention to the first volume of this comprehensive undertaking. The second volume is also characterized by able accounts of the various medical problems in industry, written by practitioners who have obviously had adequate personal and practical experience of their subjects.

Compressed air illness is dealt with in three different chapters. The special attention devoted to this subject is certainly justified by the increasing role of diving in a multiplicity of modern endeavours. There is a valuable account of the selection of men for work in compressed air, with a thoughtful warning that a medical practitioner needs some special training and experience in this kind of work:

'At the present time the examination

of men for work in compressed air is made by doctors in practice near the place at which work is to be done. As a rule, these practitioners have no special knowledge of compressed-air illness; this, on the whole, makes them very cautious, and a man in whom any abnormality at all is found is excluded from work. This is probably sound practice so far as the working population is concerned; but it excludes too easily such people as engineers, contractors' agents and inspectors, whose exposures are normally brief and who do not perform manual labour. It is questionable, too, whether the habitual absolute exclusion of the old and the fat is always necessary' (p. 186).

The treatment of the mild or severe case of the 'bends' is also dealt with very thoroughly.

The entirely novel information the practitioner must acquire in the field of industrial medicine is illustrated by the effects of intense sound and ultra-sound. Knowledge of the physiology of hearing and the pathological consequences of sound waves have both increased considerably in recent years, and is of course particularly needed in this age of jet engines. Important is the recognition of the fact that 'A partial hearing loss greater than would be expected on the basis of age alone seems to be statistically evident among workers in very noisy industries, including certain branches of military service. It is possible that many cases of definite hearing loss may be due to single exposure to a louder than usual sound and not strictly to a cumulative effect of more moderate exposures' (p. 368).

This evidence is particularly relevant at a time when some psychologists have elected to dogmatize about the harmlessness of living amid noise.

The concluding section of the volume deals with ionizing radiations (a subject of great practical importance in view of the increasing therapeutic use of radio-active isotopes) and stresses the clinical effects of radiation.

These two volumes are clearly important not only for the practitioner devoting himself wholly to the field of industrial medicine, but also for such of his colleagues as the otologist, the ophthalmologist, the dermatologist and the radiotherapist.

Pulmonary Oedema

Acute Pulmonary Edema. By Mark D. Altschule, M.D. (Pp. 66 + Index. s. d.) New York: Grune & Stratton Inc., 1954.

Contents: 1. Clinical Manifestations. 2. Basic Physiologic Considerations. 3. Pathologic Physiology. 4. Treatment. Bibliography. Index.

Some degree of pulmonary oedema features almost invariably in most autopsy reports. Perhaps the observation is made rather loosely without a proper regard to the different criteria of 'normal' to be applied to dead bodies which have lain on their backs for some 24-48 hours. Certainly the quantitative measurement of lung oedema is a difficult matter in the dead. Paradoxically, its recognition may well be easier in the living.

The forensic pathologist should read Professor Altschule's monograph with particular attention and profit, as it throws light on important medico-legal aspects of a problem which must often be unravelled at autopsy from the standpoint of toxicology or traumatic pathology.

The emphasis on our limited knowledge of the physiological and pathological mechanisms of pulmonary oedema is timely. The author provides a scientific basis for an approach to the meaning of this clinical event, and certainly the reminder is most opportune that a fairly common type of lesion that may cause pulmonary oedema is cerebral trauma. (This is apart from the oedema resulting from brain tumour.)

This is an important monograph both for the clinical and the medico-legal practitioner.

Correspondence

Estimation of Stature from the Long Bones

To the Editor: In the first issue of this *Journal*[1] I presented a short account of the accuracy to be expected in estimating the stature of an individual from the length of the long bones. Since that article appeared a fresh survey of the subject has been made by Harrison[2] in a book describing the investigations undertaken in the Christie case. With some aspects of this presentation I find myself in disagreement and I am therefore grateful for an opportunity to take issue with him.

Harrison repeats a procedure suggested by Boyd and Trevor[3] in which the estimates derived from all the available formulae (10 or more) are pooled and a mean estimate derived from them. (Trotter and Gleser[4] have shown that in the case of their material, which is the finest yet presented, the procedure mentioned gives rise to more rather than less error in the final estimate.) But Harrison goes further and presents a statistical estimate of the variation among these predictions (standard deviation and standard error of the mean) and claims that the 5% fiducial limits of the mean (±twice its standard error) provide limits 'outside which we should expect the true height to lie in less than 5 in 100 cases examined'.

It is clear that the various formulae, based as they are on the lengths of the same 6 bones taken separately or in conjunction, will produce estimates the variation in which is a measure of the closeness with which the relations between the lengths of the limbs and limb segments in the particular subject approach the mean proportions in the population which are reflected in the formulae. For example, in a subject whose limbs were uniformly long in relation to his stature (i.e. with intermembral, radio-humeral and tibio-femoral indices near the average values for the appropriate population) the several estimates would vary among themselves but little, in spite of a mean estimate which would be much above the true stature. The accuracy of a formula can be deduced from the various correlations on which it is based, but it can only be conclusively verified by applying the formula to a reasonably large fresh sample. Only Trotter and Gleser have been able to apply this stringent test—to their white male formulae—and in 100 fresh cases discovered a range of errors of the expected magnitude (from −6 cm. to +9 cm.).

Harrison remarks that the mean estimates were remarkably accurate in the 5 cases which he describes in detail. Two observations are pertinent.

1. In 4 of these cases (the 2 skeletons in the Christie case and the 2 bodies in the Ruxton case) no measurements of the living subjects were available. The full details of the fifth case are not given. Therefore the results of the predictions cannot be tested exactly, as they are being compared with police estimates of the height of missing persons.

2. It can be shown that the results in these 5 cases are just as good if the multiple regression formula of Trotter and Gleser involving the lengths of humerus, femur and tibia, is used alone. The detailed comparison is as follows:

	Fuerst	*Eady*	*Ruxton*	*Rogerson*	*M.E.R.*
Presumed height (cm.)	172.7	157.5	160.5	152.4	161.1
Deviation of mean estimate ...	Nil	−1.4	+0.2	+0.6	−0.1
Deviation of Trotter and Gleser formula	+0.2	−0.5	−0.6	+0.4	−0.1

An equally instructive set of figures is provided by Boyd and Trevor. Here are shown the data of 8 male subjects whose living height was known. Using the recommended formula of Trotter and Gleser (based on the length of femur+tibia) the estimates differ from the true stature by amounts varying from +7.8 to −4.0 cm., the mean error not differing significantly from zero. This is, in my opinion, more likely to be the usual experience than that provided by the 5 cases described by Harrison.

In summary, this letter and my previous article are pleas for the rejection of the method of pooling and averaging estimates. The most accurate formula available is the one which should be used. The error involved cannot be reduced by the methods here criticized and the standard error of an estimate will not be less than 3.0 cm. even under the most favourable circumstances.

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12 March, 1955.

Breath Tests for Alcohol

To the Editor: I have had drawn to my attention the letter from Prof. R. N. Harger published in the January-March, 1955 issue of your *Journal.*

I do not propose to impose upon the *Journal* for the necessary space to reply *seriatim* to the different points raised. Recently, I had the occasion to address The Canadian Bar Association. This address will be published in the near future in the *Canadian Bar Review* and also in the *Osgoode Hall Law School Journal*—'Obiter Dicta'—and in it, I believe, will be found the necessary comments. One point, however, may be noted here. In his reference to me, Professor Harger states: 'He has repeatedly condemned breath methods, without even bothering to try them out personally'. A little history is, therefore, relevant here, and the following is, *verbatim,* from the above-mentioned address to The Canadian Bar Association:

'Coming to the history of these tests, the first fact to note is that none of the tests—blood, urine, saliva, breath, etc.—is new. What is new is their use in

courts of law and the manner in which they are being increasingly so used. The first test for legal purposes dates back to 1923 only, when it was used in a coroner's court to determine the cause of death. By 1930, chemical tests were accepted as evidence of alcoholic intoxication in living cases in courts of law in Sweden and other European countries. A few years later, Indiana was, I believe, the first to so use them on this continent. Since then, their use for forensic purposes has rapidly increased, and the incentive then, as that which accounts for their wide use at present, was an attempt to solve the problem of the increasing number of fatalities from motor vehicle accidents.

But long before there was the motor vehicle problem there was a *diabetic* problem, and in no condition in medicine was the employment of alcohol then more useful nor more justifiable. Before the discovery of insulin, which was only 33 years ago, alcohol was the only food which the diabetic was able to utilize completely and convert into useful energy. Alcohol was, however, also capable of doing harm. Because of this, and also because of other problems of human nutrition, it was necessary to know as much as possible about the effects of alcohol on the human body. For this purpose, it was necessary to devise tests for alcohol in blood, urine, saliva and breath and all other body materials. Tests for alcohol in these materials thus date back well over 50 years—that of breath to 1891; urine and saliva to 1899, and blood alcohol to about 1903. Even the test for alcohol in cerebrospinal fluid, to which it will be necessary to refer later, is not as recent a refinement of technique as some medico-legal experts seem to believe, judging from their writings; in animals, the test dates back to 1900 and, in man, to 1913.

It was from studies on diabetics and from experiments in nutrition in general that practically all of the *fundamental* knowledge of the metabolism of alcohol in the human body which is known at present was known long before any of these chemical tests were employed for purposes of law. How alcohol is absorbed by the different organs of the body when it is taken by mouth; the rates at which it is so absorbed; how, after its absorption, it is distributed throughout the different tissues of the body; the rates at which these distributions occur; how the human body utilizes alcohol as a food; the different rates at which it is so utilized under different conditions; the physiological effects of alcohol otherwise and its pathological effects; how alcohol is eliminated by the body, and the different rates at which it is eliminated is old information. The special field of medicine which deals with all of these matters is known as *metabolism*. (Lantern slides were here shown which illustrated the highly accurate types of apparatus which were required for these studies).'

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